WATER & SEWAGE WORKS

UNIVERSITY MICROFILMS
313 N. 1ST ST.
ANN ARBOR, MICH.
COMP

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL

Residential Subdivision Sewage Plant, Dade County, Fla.

See Sewage and Wastes in 1954—Page 47

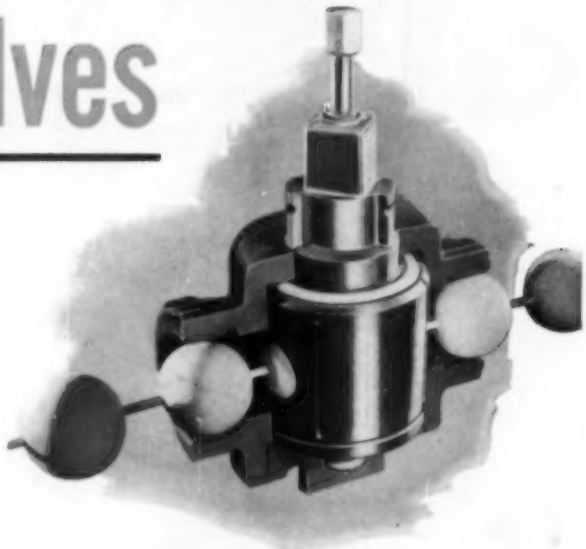
Automatic Control of Water Fluoridation

Low Cost Secondary Treatment by New Cavitation System

FEBRUARY 1955

THE "HOLE" TRUTH

ABOUT round port plug valves

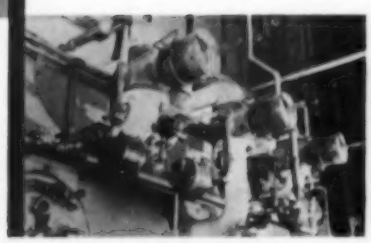


The truth is: no other opening will give you the flow perfection of a round hole! Because acf Round Port Valves are the exact size and shape as the pipe itself...you get smooth, unrestricted flow of even the most heavy viscous ladings. There are no obstructions...no loss in head pressure...no turbulence and harmful abrasive effects from solids in suspension.

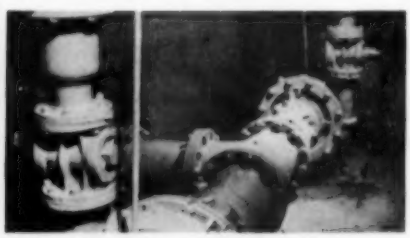
Quarter-turn shut off! Full pipe area opening! Non-wedging design! All these features are found in *both* acf Round Port Valves and Rectangular Port Valves. Their extra long service life with minimum maintenance will save you money in the long run. And that's the truth!

Representatives in 50 Principal Cities. Write for descriptive Catalog 5-WS, acf Industries, Incorporated, Valve Division, 1501 E. Ferry Avenue, Detroit 11, Michigan.

In Sewage treatment



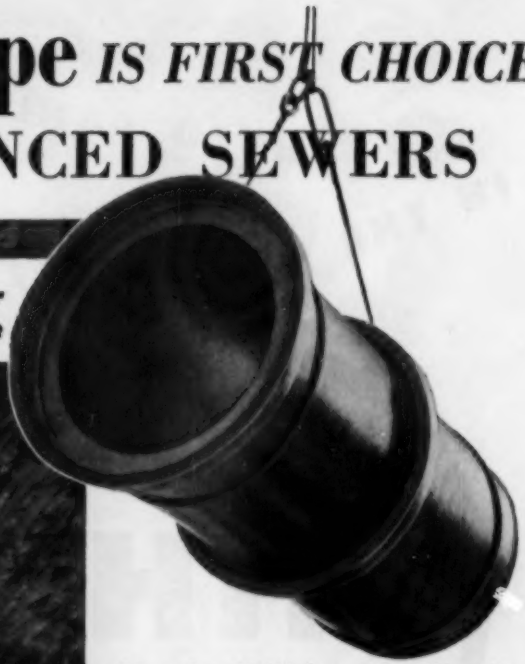
In Steel Plants



In the Cement Industry

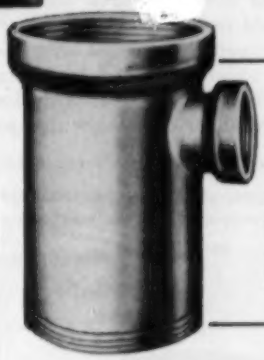
acf CYLINDRICAL PLUG VALVES

Guaranteed Clay Pipe *IS FIRST CHOICE* FOR BOND-FINANCED SEWERS



More than 59,000 feet of Clay Pipe, 18 to 36 inches, are being installed in Wichita, Kan., under the direction of Eugene N. Smith, City Manager; George J. Fisher, Director of Service; and B. E. Smith, City Engineer. Contractor is Utility Contractors, Inc., under Paul W. Brock, President. Project Engineer: Ray E. Lawrence. Resident Engineer: Don Proudfit. Consulting Engineers: Black and Veatch.

When taxpayers approve a sewerage bond issue, they're giving a vote of confidence to the good judgment of the men who will specify the pipe. Bond-financed sewers *must* give long, trouble-free service. You can be absolutely sure of their dependability when you use guaranteed Vitrified Clay Pipe. Clay Pipe installed today will be good as new long after the bond issue is retired. Alkaline soils or acid sewer gases can't corrode it. Corrosive industrial waste doesn't affect it. There's *no safe substitute* for chemically inert Clay Pipe. It's guaranteed for 50 years!



A complete line of fittings solves every installation problem when you specify Clay Pipe. This T-Branch, for example, enables you to joint feeder lines into a trunk without patching or using substitute materials.

NATIONAL CLAY PIPE MANUFACTURERS, INC.

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Vitrified
CLAY
PIPE

HOLD SANITATION PROBLEMS IN THE PALM OF YOUR HAND WITH HTH TABLETS

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- Sanitizing new wells, both during and after drilling.
- Destroying offensive odors originating in stagnant ponds, ditches, etc., especially those subject to seepage from septic tanks.
- Controlling the breeding of mosquitoes, flies and insects.
- Disinfecting effluents, controlling odors, and B.O.D. reduction at sewage disposal plants.
- Miscellaneous sanitizing and deodorizing.

MATHIESON

HTH Tablets contain not less than 70% available chlorine. They are packed in 100-lb. lithographed steel drums and in cases of six 7½-lb. cans.

2885

Get complete information from your HTH supply house or mail this coupon for detailed literature.

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Industrial Chemicals Division
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WATER & SEWAGE WORKS

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INDUSTRIAL WASTE TREATMENT

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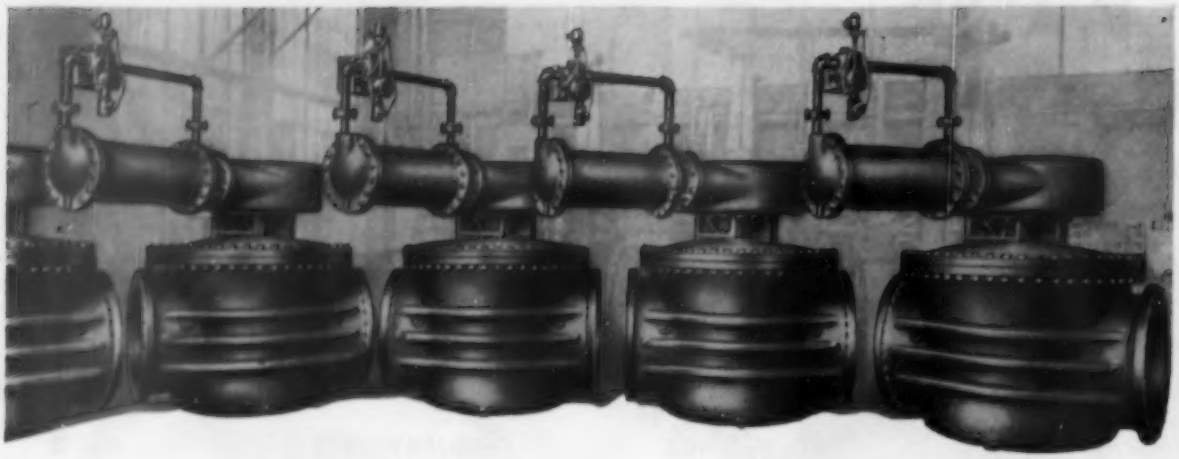

36" CONE VALVES *with clear* OPENING

. . . 52 of these
CHAPMAN
Automatic Cone Valves supplied for TVA

To supplement its hydro-electric power, TVA has built a series of steam plants on the Tennessee and Ohio rivers. These new units will furnish power required for Atomic Energy and other projects.

In this vital program, 52 Chapman Automatic Cone Valves were utilized for these plants . . . to act as check valves on the condenser water pumps. Each of these valves weighs approximately 11 tons.

Chapman designs and builds these valves in a range of sizes from 6" to 48" for check, throttling, pressure reduction and stop valve service. This is only one of many special Chapman valves. Remember, there's no problem in flow control that's too big or too tough for Chapman. That's why it saves time and money to *check with Chapman first, every time.*

The CHAPMAN VALVE
MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS

NASHVILLE, TENN.

Nashville Filter Plant

(EXPANSION COMPLETED IN 1951)

THE CHESTER ENGINEERS
Consultants
PITTSBURGH, PENN.

Nashville Filter Plant showing aerator, grit chamber, mixing basins, setting basins, and filter building.

Mr. Robert L. Lawrence, Jr., Director and Chief Engr. Water Works Dept., at the Master Control Table in the original plant lobby.

Filter Operating Gallery.

This 56 MGD Plant is a good example of what can be accomplished through: (1) careful engineering, (2) improved chemical treatment techniques, and (3) efficient operation by means of complete instrumentation and control. These factors have resulted in substantial savings in the cost of treated water at Nashville.

Builders Water Works Equipment (installed in the new section by J. B. Michael & Co., Inc.) has contributed to this successful history, both in the original plant and in the recently completed addition. For a detailed description of this equipment — Filter Controllers and Gauges, Pneumatic Master Control System, Chronoflo Meters and Summator, and Wheeler Filter Bottoms — address Builders-Providence, Inc., Providence 1, Rhode Island.

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DIVISION OF B-I-F INDUSTRIES, INC.

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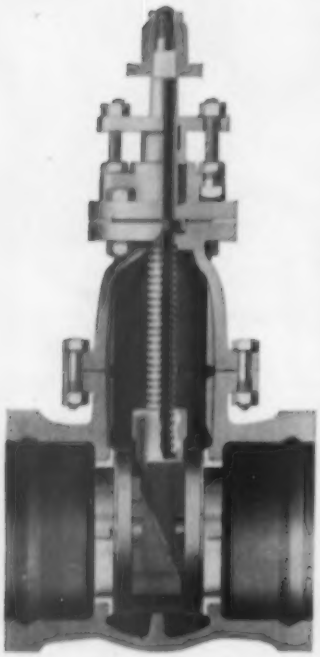
BIF METERS FEEDERS CONTROLS

DARLING VALVES

Serving Municipalities and Public Works everywhere



Note rugged simplicity of this unique Darling principle—just four sturdy working parts . . . two plain interchangeable no-pocket discs and two husky wedges. With this foolproof assembly, maintenance is easy.

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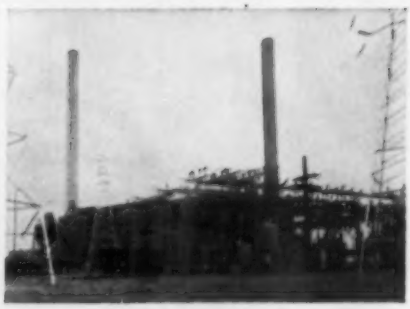

POWER PLANTS

DARLING Revolving Double Disc VALVES are stand-outs in every application

AN enviable record for outstanding public service . . . and of course there are many good reasons for Darling valve dependability and low-cost service.

1. The *fully revolving double disc parallel seat* Darling valve compensates automatically for any valve body distortion . . . your assurance of tight closure even under extreme service conditions.

2. The *fully revolving double discs* minimize wear and assure you of tight closure throughout the life of the valve.

Water and sewage engineers everywhere are saving time and cutting valve maintenance costs thanks to Darling *revolving disc* gate valves. Darlings are available in a wide range of sizes for all normal and unusual service . . . for pressures up to 1500 pounds. Write for all the facts. *Address* . . .

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Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario

how much does it cost... to have *Safest* CHLORINATION?

Nothing—when you buy a Fischer & Porter Chlorinator. That's true because fool-proof safety features are already engineered into this modern, instrument-type chlorinator.

> The F&P Chlorinator is instrument engineered from top to bottom to be absolutely safe in any emergency—and the safety features respond instantly. The mechanical design—without hydraulic devices to introduce time lag—make this a certainty . . .

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In the F&P Chlorinator you can pull the flow setting needle valve right out of its socket—and the chlorinator shuts down *instantly*.

In the F&P Chlorinator you can shut off the ejector water supply while leaving the chlorine on—and the chlorinator shuts down *instantly*.

In the F&P Chlorinator a simple series of hand manipulations tests each safety component—or shows the reason for malfunctioning should it ever occur.

These safety advantages are yours in the Fischer & Porter Chlorinator. They cost you not one penny more at the outset, since the F&P Chlorinator is lower in first cost. They avoid constant costs of repeated safety tests and checks. They assure you against high costs of repairs and maintenance. We don't put our safety devices under a bell jar—they are right out in the open where you can see and touch them.

These engineered features—*instrument-type engineering*—make the F&P Chlorinator the safest ever built. And you get all these safety features *plus* ease of operation, dependability proven in over 600 operating units, complete corrosion resistance—everything you should have in a chlorinator—and you get them for even less cost in the initial purchase. Write today for full information, details on free trial offer, and *absolute guarantee of satisfaction.*

complete process instrumentation

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18 YEARS SUCCESSFULLY MANUFACTURING CHLORINE CONTROL EQUIPMENT

ACT NOW!

eliminate "orphans" from your fire protection system . . . with

IOWA

GATE VALVES and FIRE HYDRANTS

Don't Gamble on Obsolete Equipment

...BE READY FOR ANY EMERGENCY!

"Forever" is such a long, long time. In this H-bomb age, we hesitate to promise that replacement parts for Iowa Hydrants and Gate Valves will be available "forever." But we'd like to—because, actually, replacements are readily available today for every part of every hydrant and gate valve Iowa ever has made. That's a record that extends way back to 1909—almost a half century ago. It's a record we plan to maintain. So, this much we can say: You're as "safe as safe can be" in replacing NOW with time-proved Iowa. For full details, please write TODAY!

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Open with the pressure for faster water delivery.

Close *against* the pressure to eliminate water hammer, provide flushing action.

Assure positive drainage.

Are available for any type of connection.

All working parts removable through top—no digging or special tools required.

Meet all A.W.W.A. specifications.

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Double disc, parallel seat.

Positive wedging action for efficient, no-leak closing.

Gates hung loosely from stem nut—no binding.

Rugged, time-proved design means long life, low service costs.

Available with bell, flange, or mechanical joint connections to fit any existing or planned installation.

Meet all A.W.W.A. specifications.

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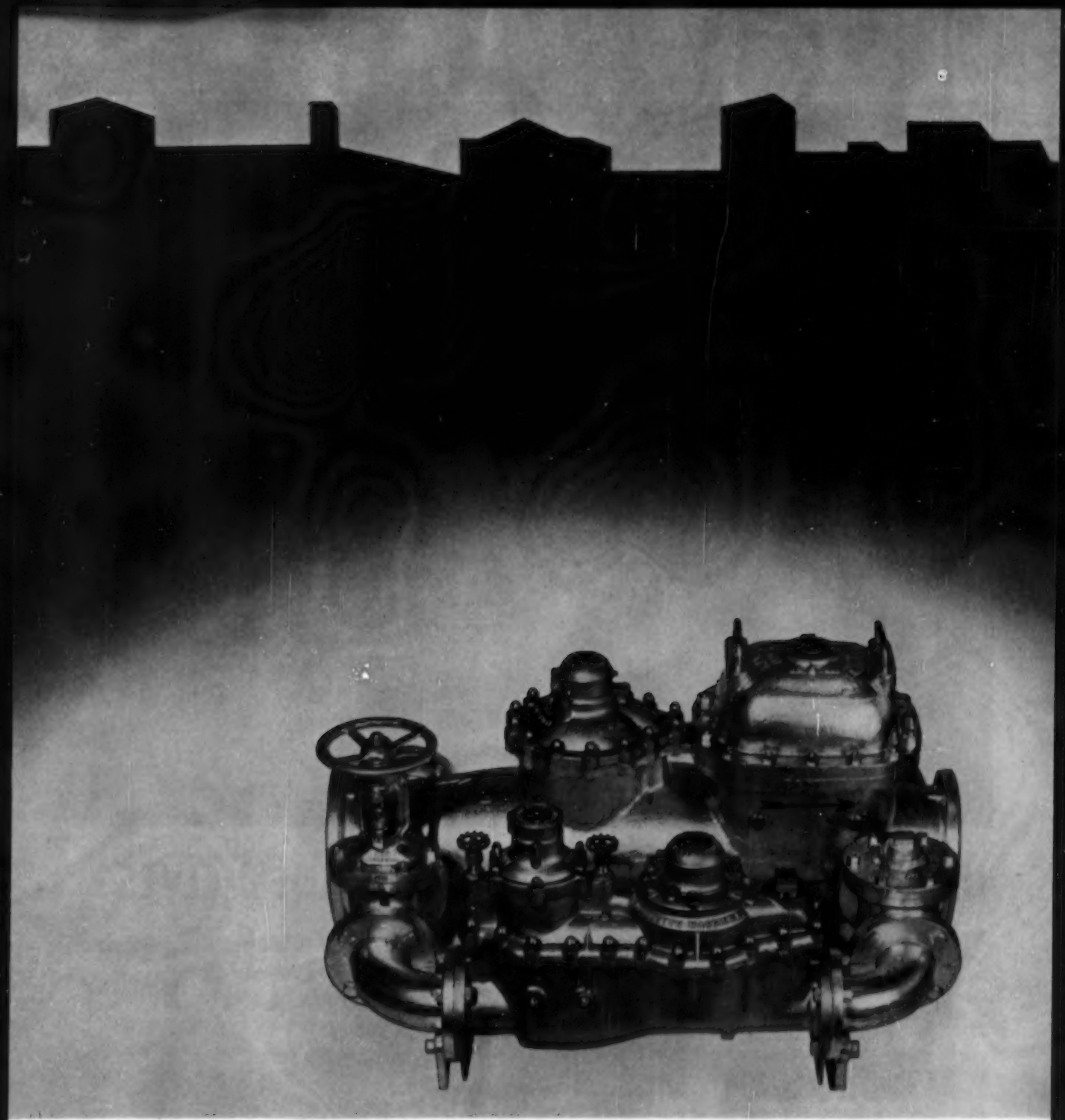
Oskaloosa, Iowa • *A Subsidiary of James B. Clow & Sons*



THE HERSEY DETECTOR METER

with Disc Meter or (as illustrated above) the Hersey Bronze Case Compound Meter on the by-pass, is standard equipment on the fire services of many large industrial plants throughout the nation.

A Hersey creation that has never been equaled — Write for full details

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What you see here is routine procedure on raw materials coming to Crane. There's no unloading of the more than 3,000 incoming carloads per year until the Crane Quality Control Lab gives an unqualified O.K.

The extra care that Crane gives to raw materials, and similarly to every step in manufacturing, pays off in better valves for you. You can be sure that Crane stands for quality that results in lower cost in the long run.

That's another reason why thrifty buyers prefer Crane valves. They know they're investing in better piping performance as well as protecting against untimely and excessive maintenance. A mighty important consideration in these days of high costs. And, surely, the main reason why industry keeps using more Crane valves than any other make.

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Bigger Selection
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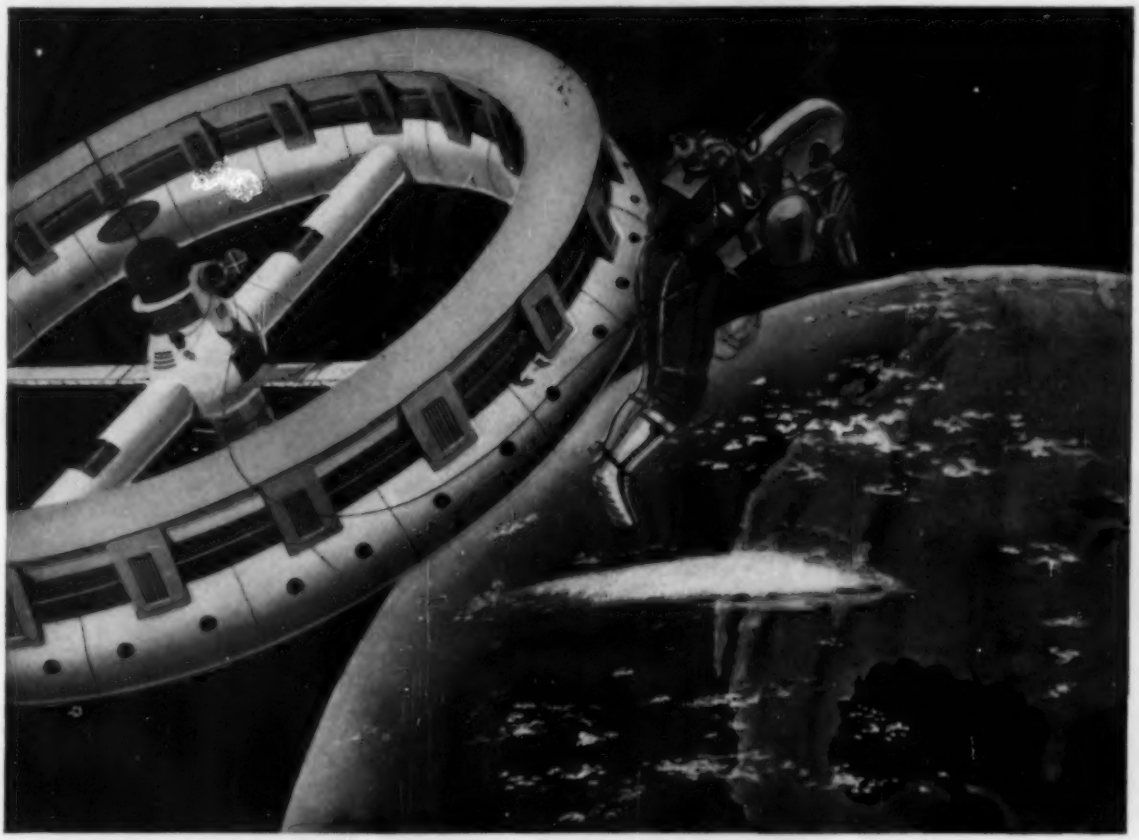


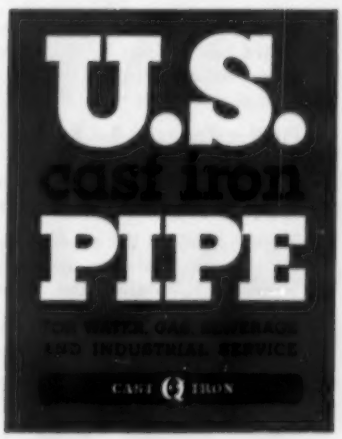
A SPACE STATION . . . a thousand miles high in the stratosphere slowly circling the globe . . . observers near its rim studying cloud formations and the earth's atmospheric conditions below . . . this may be our weather bureau of the future.

100 years from now... A MAN-MADE "MOON" MAY BE OUR WEATHER BUREAU

OUR WORLD of tomorrow will bring many changes. But in one vital aspect of American living, your great-grandchildren will continue to enjoy the same dependability and service you know today. *Cast iron pipe laid today will still carry water and gas to their homes.*

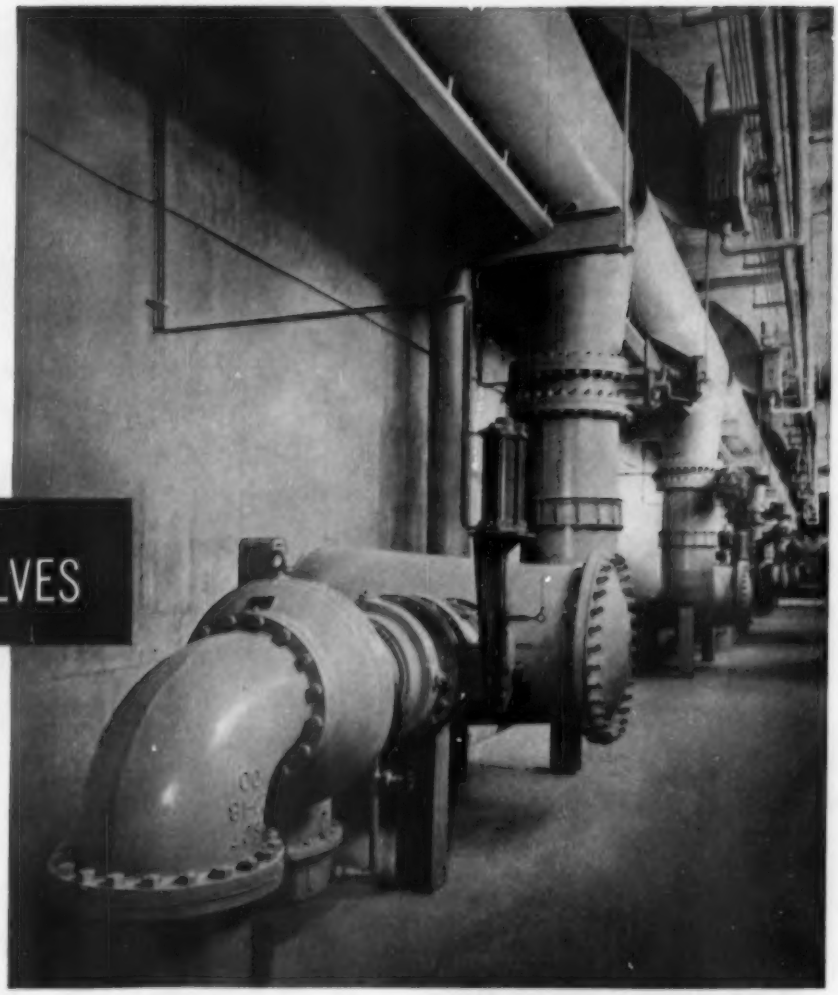
Today, over sixty American cities and towns are still served by cast iron water and gas mains laid 100 and more years ago. And modernized cast iron pipe, centrifugally cast, is even stronger, tougher, more durable.

U. S. Pipe is proud to be one of the leaders in a forward-looking industry whose service to the world is measured in centuries.



United States Pipe and Foundry Company
General Office: Birmingham 2, Ala.

A wholly integrated producer from mines and blast furnaces to finished pipe.



R-S
BUTTERFLY VALVES

San Jacinto Project uses 66 large R-S Butterfly valves

CITY OF HOUSTON SAVES $124,000 with DROP-TIGHT RUBBER-SEATED VALVES

Choosing R-S Rubber-Seated Butterfly Valves enabled Freese, Nichols & Turner, Consultants on the San Jacinto River project, to save $124,000 for the City of Houston. Use of 65 of these valves for all low-pressure service gave a substantial space reduction and the direct, in-place cash savings over gate valves. SMS cone check valves were also chosen for pump discharge service.

Positive closure in R-S Rubber-Seated Valves is obtained by wedge-type closure of the disk within a one-piece rubber seat. Tough, flexible rubber seals the entire disk seat – including the area around the shaft bosses. Supervised testing of a six inch R-S Rubber-Seated Valve proved that after 6,000 closings the valve was still giving positive shutoff at 100 psig water.

These valves are the product of over 75 years of design and engineering experience in the hydraulics field. To find out more about our complete line—R-S Butterfly, Rotovalves and Ball Valves – write to S. Morgan Smith Company, York, Pennsylvania.

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Pumps
Gates & Hoists
Trash Rakes
Accessories

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Rotovalves
Ball Valves
Butterfly Valves
Free-Discharge Valves
Controllable-Pitch Ship Propellers

S. MORGAN SMITH CO.

SMS

Water is vital...

Badger meters conserve it better!

IN only one year, more than *26-million tons of paper* are required to fill the needs of the nation . . . to help business operate, to serve personal needs, to bring your daily newspaper to your door. Yet it takes *more water than wood* to produce this paper.

The Badger water meters used in America help save water for this vital need . . . measure water accurately for homes and industry . . . provide a precise check of water usage and waste. And they make certain that users pay fairly for the water consumed . . . help make water departments self-supporting.

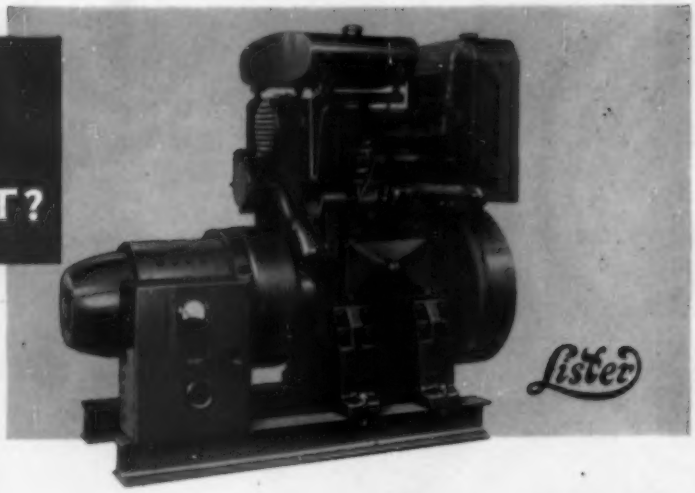
As a result of their superior performance through the years, Badger meters are the favorites of waterworks men everywhere . . . famous as the meters that save water, work and money.

Badger Water Meters

Badger Meter Mfg. Co.
Milwaukee 45, Wisconsin

"Measuring the water of the world for 50 years"

NEED A FUEL-SAVING ELECTRIC PLANT?

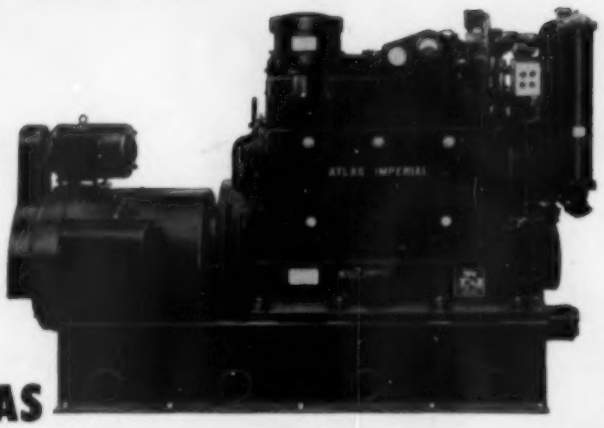


Then you'll certainly want all of the facts on the diesel engines that have consistently provided dependable power for generator operation *at the lowest fuel cost per kilowatt hour!*

These famous Superior, Atlas and Lister Diesels are widely used for generator power in municipal light plants, water works, sewage plants . . . for standby power in countless industrial operations . . . and for both propulsion and auxiliary power throughout the marine field.

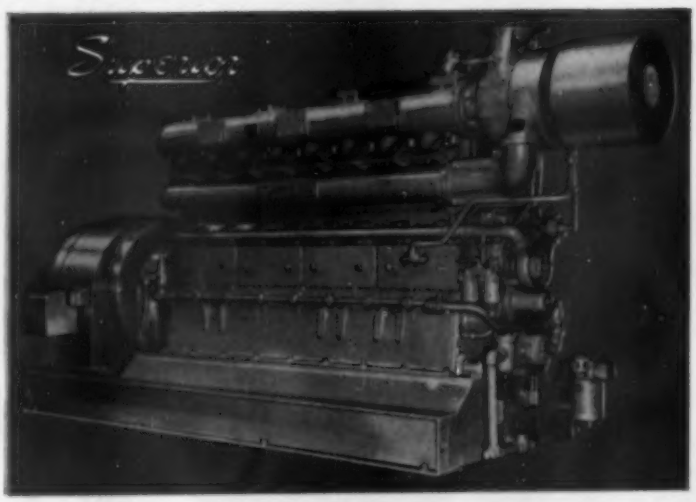
Performance and operating records from hundreds of these installations prove the exceptional economy of National Supply Diesel engines in service. This reputation, plus efficient 4-cycle design and rugged construction, make Superior Atlas or Lister Diesels your best engine investment for power generation.

These National Supply engines are available in a complete range of horsepower ratings to suit virtually every output need (check chart below). For complete information, write or call the nearest sales or service point.



ATLAS

Engine Model	Recommended Generator Capacities
LISTER FR 1	3— 5 KW
LISTER FR 2	10—12 KW
LISTER FR 3	15—18 KW
LISTER FR 4	20—24 KW
LISTER FR 6	30—35 KW
ATLAS Model 35	100 KW to 200 KW
ATLAS Model 45	100 KW to 400 KW
SUPERIOR Model 40	155 KW to 500 KW
SUPERIOR Model 60	280 KW to 645 KW
SUPERIOR Model 65	420 KW to 1250 KW
SUPERIOR Model 80	450 KW to 1000 KW



X-4019

DIESEL DUAL FUEL GAS

ATLAS

ENGINES

DISTRIBUTOR OF Lister DIESELS IN U.S.A.

THE NATIONAL SUPPLY COMPANY

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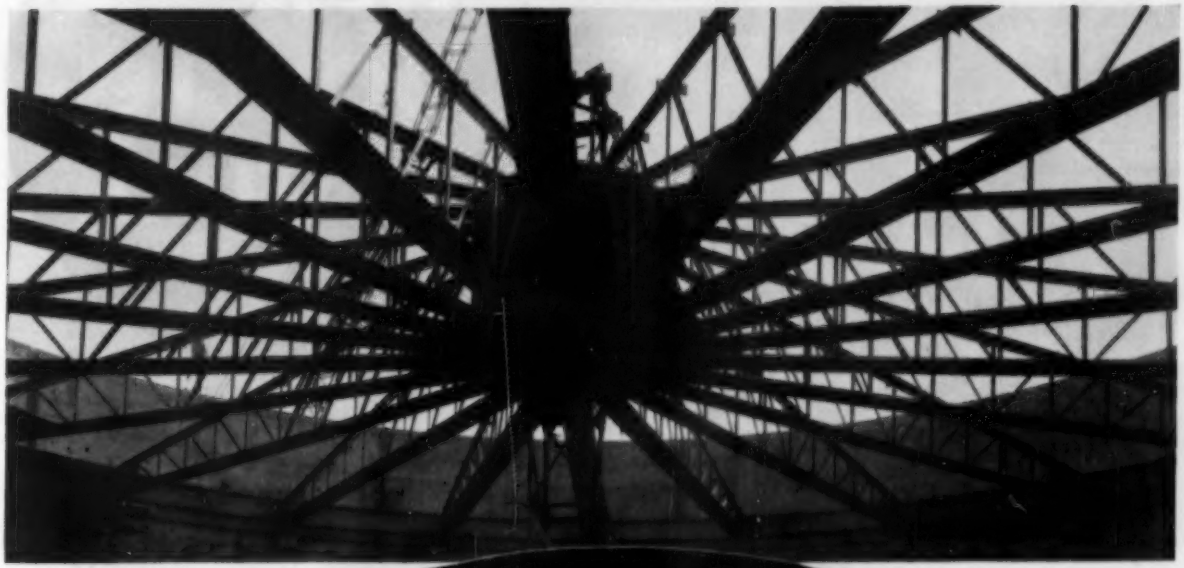
FRAMEWORK of Economy



Framework of P.F.T. floating cover being built for a sewage digestion tank.

Five sewage digestion tanks with steel floating covers and a 50,000-gal. Horton Watersphere® at the Sacramento Sewage Disposal Plant.

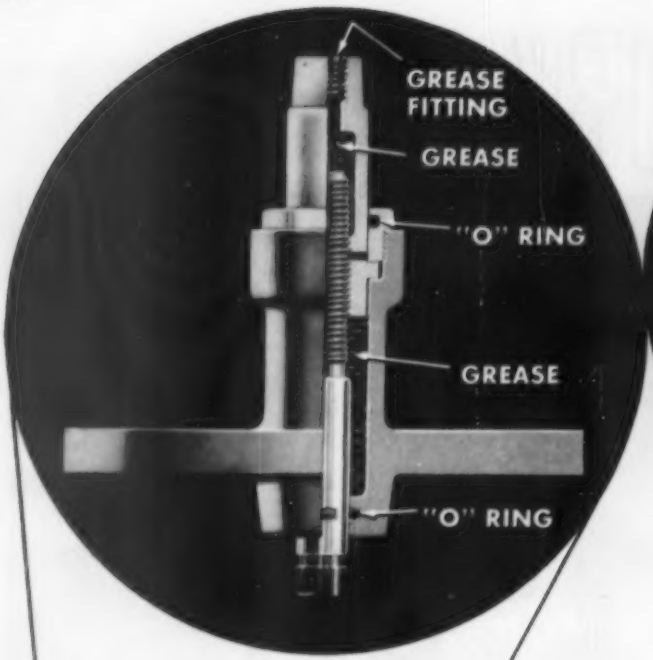
for Sacramento Sewage Disposal Plant

This intricate framework was built for one of the five P.F.T. steel floating covers installed on the 100-ft. diam. digestion tanks at the City of Sacramento's sewage disposal plant by the Chicago Bridge & Iron Company. The floating covers aid the economical production and recovery of sludge gas which in turn, is used to heat sludge and for heating buildings. This is but one example of CB&I's ability to build welded steel plate structures for economy and utility. Write our nearest office for further information on tanks and steel plate work.

CBI

Chicago Bridge & Iron Company

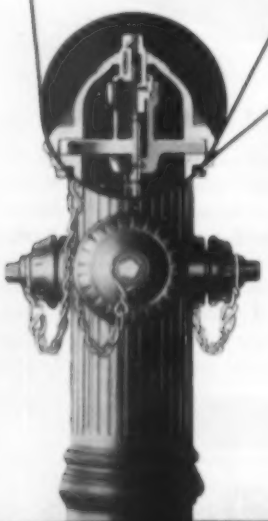
Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • Tulsa • Washington
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.



NEW DOUBLE FEATURE

SMITH HYDRANTS[48]

WITH "O" RING-SEAL AND GREASE CHAMBER FOR OPERATING THREADS



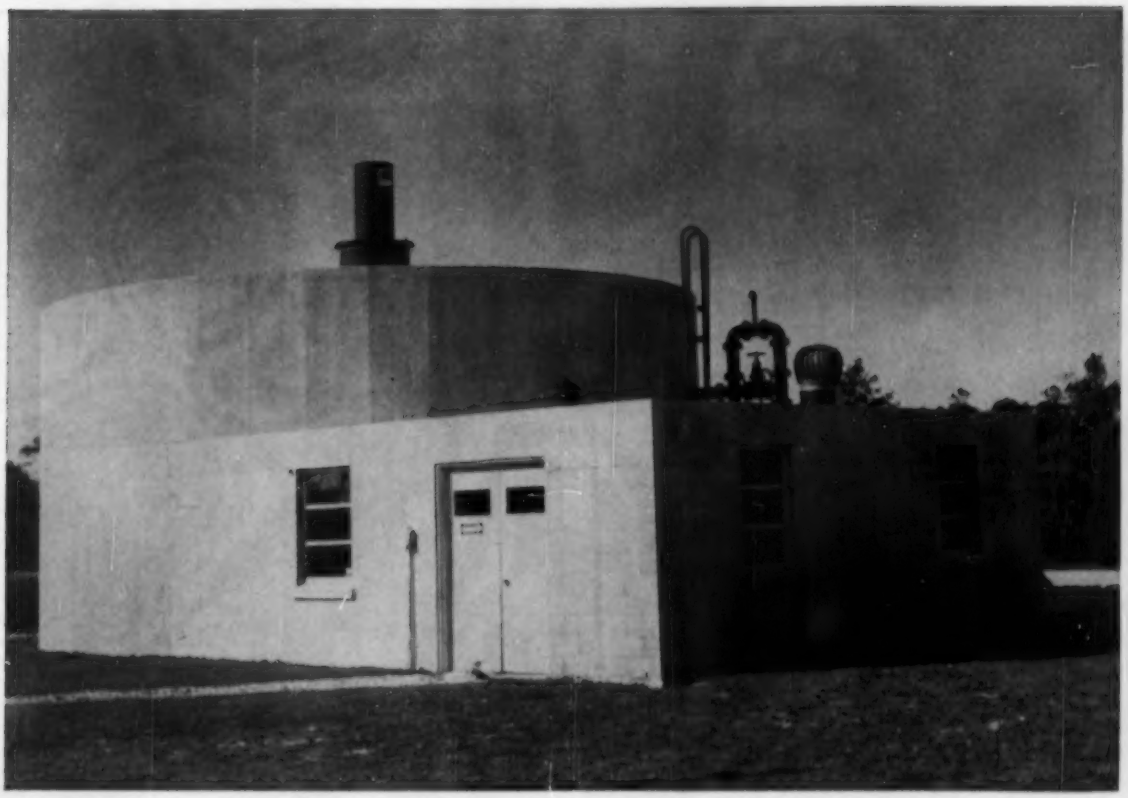
When you specify "O" Ring Seals rather than conventional packing you reduce maintenance to a minimum. The lower "O" Ring is the pressure seal, the upper "O" Ring the dirt seal. The initial compression of the "O" Rings provides the seal when the hydrant is closed. When subject to water pressure the lower "O" Ring is forced to the top of the groove. The sealing force increases as the pressure increases. The specially compounded rubber plastic "O" Rings insure a long life pressure seal. Each time the hydrant is operated, the "O" Ring Seals, the bearing surfaces, and the operating threads are automatically lubricated. Threads and upper section of the stem are continuously lubricated and sealed from contact with water in the standpipe. The lubricant is suitable for temperatures of minus 30 degrees to 200 degrees. All Smith Hydrants including hydrants in service can be fitted with "O" Ring Seal Plates.

FIRE HYDRANTS · VALVES · SINCE 1896

THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

Florida's big clean-up moves ahead!



Progressive Eustis, Florida Adopts

PFT "CONTROLLED DIGESTION"

Joining Tallahassee, Tampa, Orlando, and other Florida cities, Eustis is taking part in a great *state-wide* sewage treatment program! Eustis, like the larger plants mentioned (and others under construction), chose modern PFT equipment for effective treatment through "controlled digestion."

Designed for complete treatment of a 5,500 population equivalent, the plant commenced operation in June, 1953. Treating a sewage flow of 100 gallons per capita per day, it uses high rate filters with chlorination and discharges into Trout Lake, a tributary to Lake Eustis.

Essential to the plant's effective treatment is the *PFT Floating Cover* for the 30 ft. digester (13,280 cu. ft. capacity). Floating Covers accelerate digestion by providing positive scum submergence. They simplify operations by eliminating the need for fixed levels—additions and withdrawals can be made at times best suited to the over-all operation.

In addition, Floating Covers reduce explosion hazards because gas collected under the cover is maintained at positive pressure under all operating conditions. Costly breakdowns are reduced because all moving parts are eliminated from inside the digester. Since heat is supplied from *external* heaters, all cleaning and maintenance take place *outside* the tank.

Other PFT equipment installed at Eustis includes: *Heater & Heat Exchanger unit* (100,000 B.T.U. per hour); *Flame Traps; Pressure Relief Waste Gas Flame Trap; Waste Gas Burner; Auxiliary Flame Cell; Gas Pressure Gauge; Drip Taps.*

The Eustis plant has demonstrated that PFT equipment can serve the smaller as well as the largest cities. In all installations, PFT assists consulting engineers by showing the adaptability of its equipment in meeting specific plant requirements.

Design of plant by / *Briley, Wild & Associates, Consulting Engineers; Daytona Beach, Fla.*

P.F.T.

waste treatment equipment exclusively since 1893

PACIFIC FLUSH TANK CO.

4241 Ravenswood Avenue
Chicago 13, Illinois

PORT CHESTER, N. Y. • SAN MATEO, CALIF. • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

THEY BOUGHT ON FAITH

Photo: Ewing Galloway

Montreal, world's second largest French city, is a great industrial and commercial center. This is a view of the business section, with Victoria Bridge in background.

Certificate of Membership

CIPCC

BY THESE PRESENTS BE IT KNOWN THAT

Ville de Montréal
Service Des Travaux Publics
Division des Eaux et de l'Assainissement

City of Montréal
Public Works Department
Waterworks and Sewerage Division

BY VIRTUE OF HAVING CAST IRON UNDERGROUND PRESSURE MAINS IN SERVICE FOR A CENTURY OR MORE, HAS BEEN ELECTED TO HONORARY MEMBERSHIP IN THE

CAST IRON PIPE CENTURY CLUB

Montreal's Century Club certificate is unusual because it is bi-lingual.

MODERNIZED **cast iron**

139 YEARS AGO–THEY BUY ON PROOF TODAY

MONTREAL installed cast iron water mains 139 years ago . . . and still installs them.

The oldest existing cast iron water main on the North American continent is in Montreal, Canada's largest city. It was laid 139 years ago by the Company of Proprietors of the Montreal Water Works.* Several thousand feet of 2½" and 10" cast iron pipe laid in 1816 are rendering satisfactory service as part of Montreal's 1073 miles of mains, of which approximately 96% are cast iron.

*Now, Public Works Dept., WaterWorks & Sewerage Div.

Montreal's Public Works Department, and utilities in 60 other cities, bought and installed cast iron pipe for underground mains that have been in continuous service for more than a century. They bought on faith founded in good judgment. Today, they continue to buy cast iron pipe because they have *proof* – proof of the long life, dependability and tax-saving economy of this time-defying pipe.

Cast iron pipe has been a rugged, long-lived product from the earliest days. Today's *modernized* cast iron pipe, centrifugally cast, is even stronger, tougher and more uniform in quality. And, where needed and specified, it is centrifugally lined with cement mortar to assure sustained carrying capacity throughout the long life of the pipe.

Cast Iron Pipe Research Association,
Thos. F. Wolfe, Managing Director,
122 So. Michigan Ave., Chicago 3.

CAST Q IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

This cast iron water main laid in Montreal in 1816 is still functioning after 139 years of continuous service.

pipe FOR MODERN WATER WORKS OPERATION

SPEAKING OF COSTS

Engineered by the New Orleans Sewerage and Water Board and installed by the Boh Brothers Construction Company, this 5-mile steel force main serves 15,000 suburban residents. After being laid in the trench by side boom bulldozer, the 30-inch pipe was Dresser-Coupled by 2-man crews averaging only 20 minutes per joint. Six hundred feet of main crossed the Industrial Canal. The pipe was first joined, then floated out and sunk into a dredged channel 50 feet below the surface. Navigation was interrupted for only two days.

New Orleans Tries Something New

Following installation of Dresser Couplings and Dresser Bonds, the bituminous-coated and lined pipe was backfilled with lake-shore sand.

Installing Dresser-Coupled steel pipe for the first time in sewer work, and leaving construction of lateral lines to building developers, the New Orleans Sewerage and Water Board saved 25% on this force main project.

The lighter weight steel pipe was hauled to the job by a lumberyard-type "Hyster" truck. Longer pipe lengths required less handling, fewer joints per mile

Despite the fact that this line was laid in soft trench, through peat bogs, clay and quicksand, the contractor was especially pleased at the ease and speed with which the steel pipe was joined with Dresser Couplings.

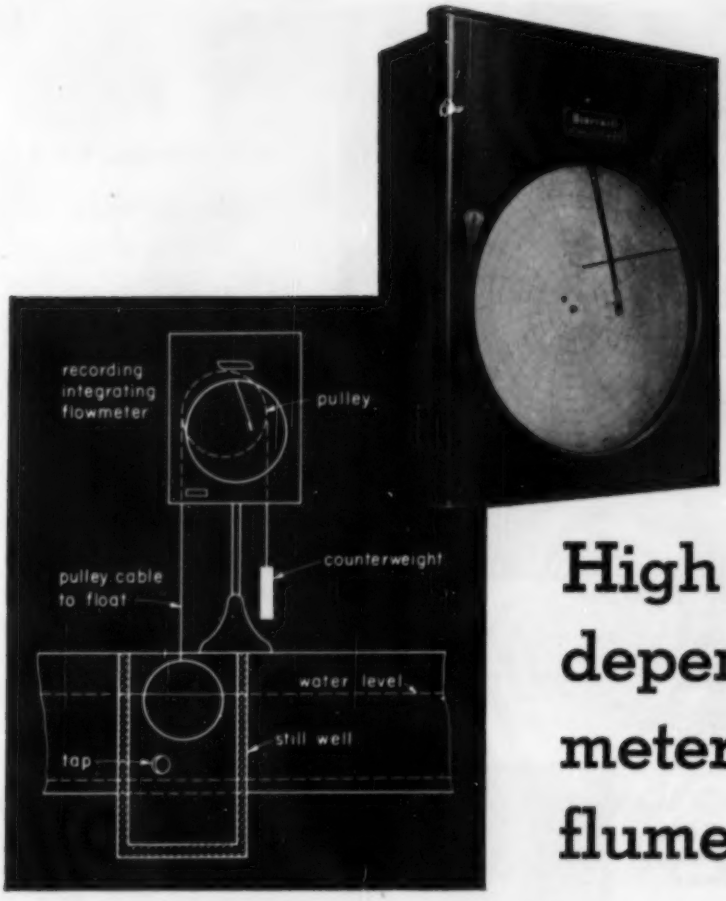
The Sewerage and Water Board—testing the main under 100 psi—was more than satisfied with the bottle tightness of the Dresser Couplings.

√ Write today for information on how you can save on sewerage and water projects.

DRESSER®

SAVE TIME · MONEY · AND TROUBLE — THE DRESSER WAY

Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston; 101 S. Airport Blvd., S. San Francisco. Sales Offices also in: New York, Philadelphia, Chicago, Toronto.



High accuracy and dependability for metering flow in flumes and weirs

Typical installation of Brown Float-Actuated Flow Meter used with Parshall flume. Instrument is rugged, simple, accurate to ± 1% of scale.

SANITARY ENGINEERS will appreciate the simplicity and accuracy of the rugged Brown Float-Actuated Flow Meter. Specially designed for use with Parshall flumes and rectangular, Cipolletti, or V-notch weirs, the instrument provides—at economical cost—*direct* measurement of flow accurate to ± 1% of scale.

The meter is built for long, dependable service . . . has a minimum number of moving parts. A hollow metal float, connected to the meter by a stainless steel cable, rides the surface of the liquid in a stilling well tapped off the flume or weir. As liquid level rises and falls, the float rotates a precision-machined pulley and cam system in the meter. The instrument indicates, records, totalizes, or controls flow . . . as desired.

Brown Float-Actuated Flow Meters can be mounted indoors, or at remote locations in weatherproof cubicles. They are simple to calibrate—all it takes is a screwdriver. And they'll hold their calibration indefinitely.

Brown Flow Meters are available with a wide choice of controls, including flexible pneumatic control of flow and chemical feeding rates. And where electric or pneumatic power may not be available, a hand-wound chart drive can be included—an especially useful feature for consulting engineers on survey work.

Your nearby Honeywell sales engineer will be glad to discuss the Brown Float-Actuated Flow Meter with you and your consulting engineer. Give him a call . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

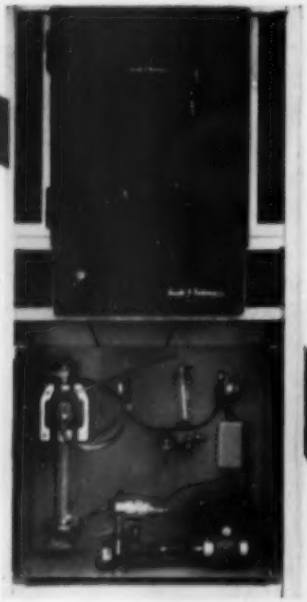
● REFERENCE DATA: Write for Honeywell Instrumentation Data Sheet No. 10.3-4a, "Brown Float-Actuated Flow Meters," and for Bulletin 7302, "Instrumentation for Water, Sewage, and Industrial Waste Treatment."

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

NEW
Arnold O. Beckman
DISSOLVED OXYGEN ANALYZER
for continuous measurement!



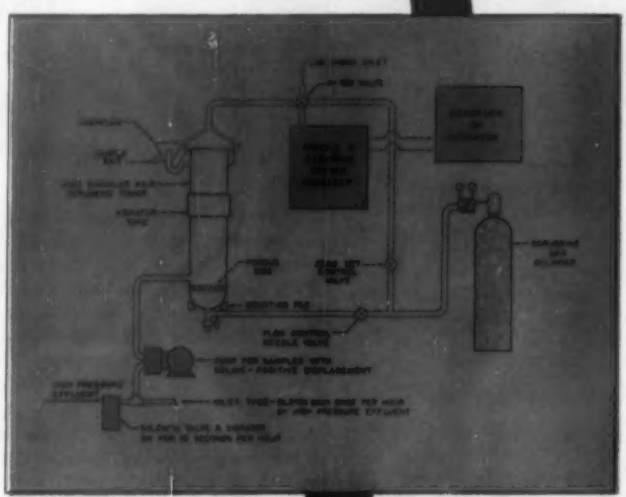
- Continuous record
- Handles fluids, slurries, sludges, etc.
- Simple operation
- Highly accurate

The accurate measurement of dissolved oxygen in fluid process streams is widely recognized as an important control factor in such municipal and industrial operations as sewage and water treatment . . . waste disposal . . . petro-chemical and chemical processes . . . food processes . . . and many others.

Now, you can make such measurements—continuously, simply and accurately—with the newly-developed Arnold O. Beckman Model 1A3B Dissolved Oxygen Analyzer!

The Model 1A3B is a complete, compact unit—with the Analyzer in top compartment and the scrubbing unit below.

- **The new Model 1A3B combines the field-proven Arnold O. Beckman paramagnetic principle of oxygen measurement with an improved method of stripping to provide a measurement specific for oxygen.**
- **The Model 1A3B is factory-calibrated to read in percent saturation so that efficiency of aeration or deaeration is shown directly. Or if preferred, the instrument can also be supplied to provide readings directly in parts-per-million.**
- **The Model 1A3B can be directly connected to any standard potentiometer-type recorder or indicator. No special accessory equipment is needed.**
- **Using the Model 1A3B is far superior—in speed, accuracy and convenience—to conventional chemical methods—and provides—immediately and continuously—the necessary control information for maintaining optimum processing uniformity.**



The Principle is simple and po[illegible]e constantly-fresh test sample in scrubbing tower is stripp[illegible]olved oxygen by inert scrubbing gas—and result measured [illegible]yzer. Measurement is continuous and accurate!

With a few variations the Model 1A3B can be adapted to a wide range of application requirements . . . to handling sludges and other liquids having high concentration of solids . . . to handling samples under abnormal pressures or temperatures . . . and to other difficult sampling conditions.

RANGES—from a m[illegible] 0-100% O_2 saturation to a minimum of 0-5 ppm, full scale. I[illegible] ranges are also available.

Arnold O. Beckm[illegible] INC.

Get the full story on this new Arnold O. Beckman development by writing directly for information on the Model 1A3B Dissolved Oxygen Analyzer. Ask for Data File # 13R—25.

Agile Oliver Hydro-Trencher digs 12-feet with ½-yd. bucket!

You can easily drive this compact, one-man trencher into spots where truck or crawler mounted units are helpless. Yet the Oliver 88WT is no small trencher. Its half-yard bucket digs to 12 feet and loads to 9½ feet. If you need more loading height, add the special hydraulic-trip loading bucket and dump at 12 feet.

The Hydro-Trencher has unmatched power and control for more profit in any digging. Two separate hydraulic circuits *keep* pressure on every move, even when you perform two operations at once. Dual controls provide speed and power variations for slicing through roots, rocky soil, hard clay, or delicately digging around pipes or foundations.

Wide bucket rotation permits fast dumping and high loading without spillage. Dirt or rocks can be clamped against the dipper stick and held at the highest level. Another thing—the trencher converts to a swing loader by simply turning the bucket around. The hydraulic stabilizer blade does two jobs, too. It holds the tractor level and steady, and doubles as a backfiller blade.

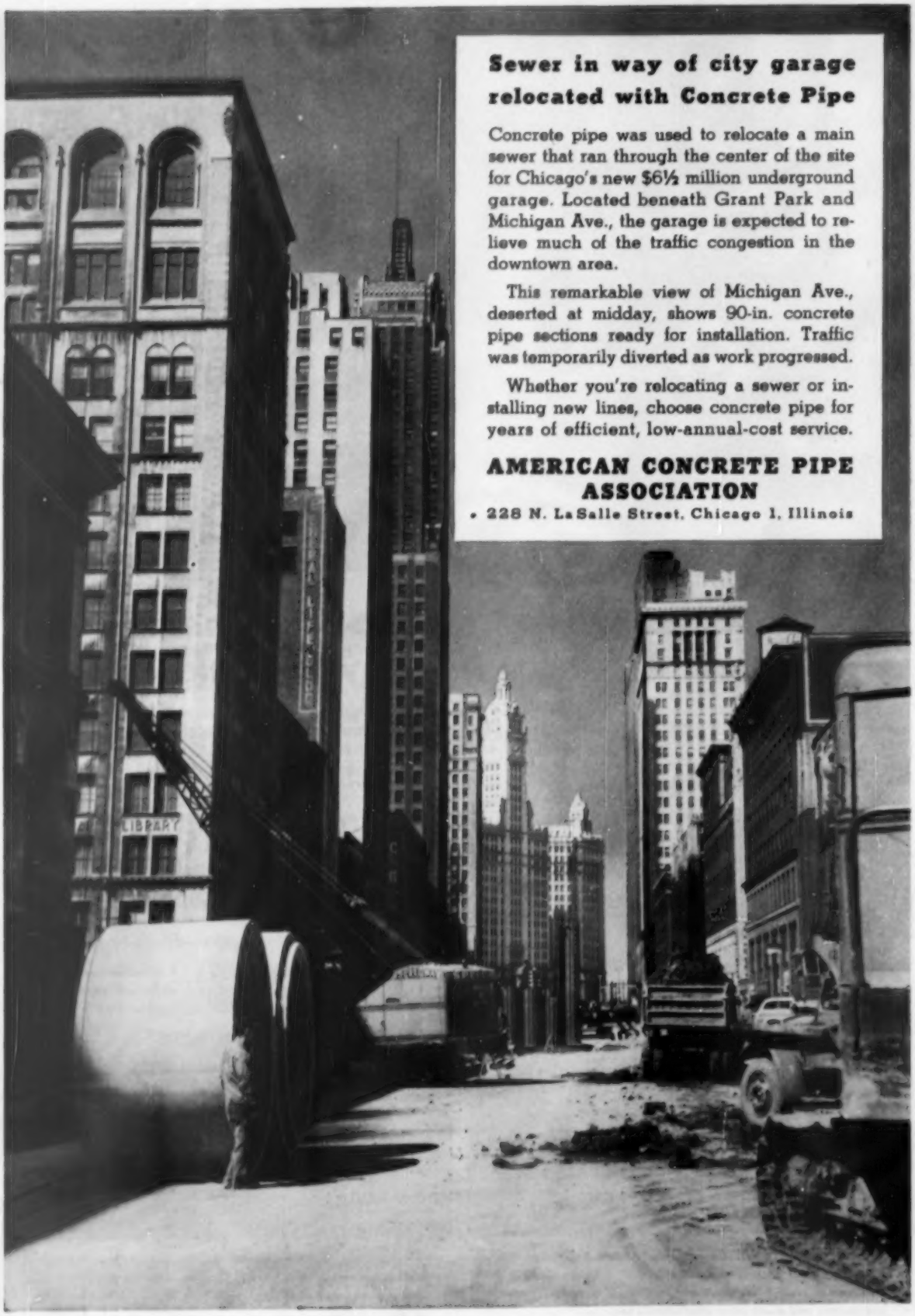
See this trencher in action. Test it yourself. Visit your Oliver Industrial Distributor. The 88WT Hydro-Trencher is available in either gas or diesel models. See it soon!

THE OLIVER CORPORATION
400 W. Madison Street, Chicago 6, Illinois

A complete line of industrial wheel and crawler tractors

This is the Oliver "OC-3" crawler with backhoe attachment. All-weather crawler traction makes the "OC-3" a handy unit for a multitude of trenching tasks. The "OC-3" takes bulldozers, front-end loaders and many other attachments, too.

Another Oliver handy for trenching is the multi-purpose Super 55. Built-in hydraulics on this tractor operate a variety of front-, side- and rear-mounted equipment. The Super 55 is available with gas or diesel engine.



Sewer in way of city garage relocated with Concrete Pipe

Concrete pipe was used to relocate a main sewer that ran through the center of the site for Chicago's new $6½ million underground garage. Located beneath Grant Park and Michigan Ave., the garage is expected to relieve much of the traffic congestion in the downtown area.

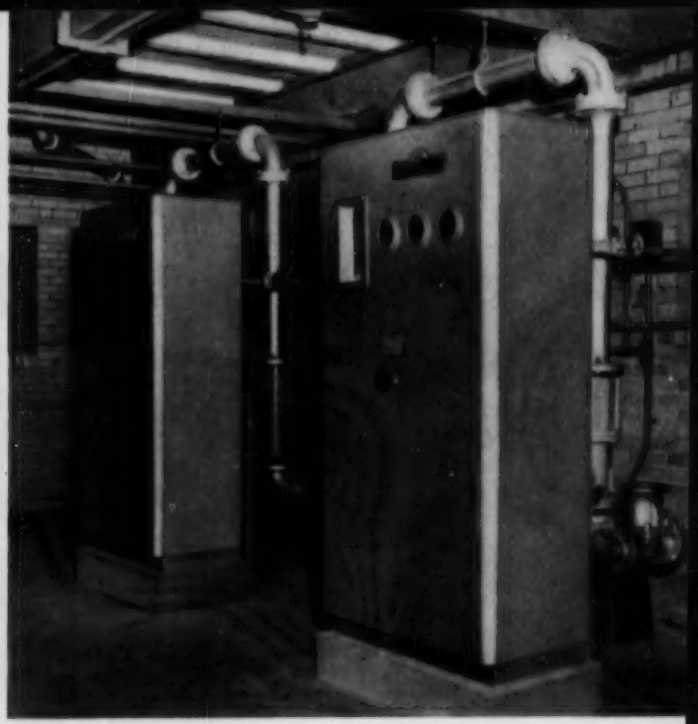
This remarkable view of Michigan Ave., deserted at midday, shows 90-in. concrete pipe sections ready for installation. Traffic was temporarily diverted as work progressed.

Whether you're relocating a sewer or installing new lines, choose concrete pipe for years of efficient, low-annual-cost service.

AMERICAN CONCRETE PIPE ASSOCIATION

• 228 N. LaSalle Street, Chicago 1, Illinois

One of the two temporary chlorinating stations which served the Blackstone Valley Sewer District during the interim disinfection period. One of the Builders Chlorinizers can be seen in the background.



Builders Model HCVS Chlorinizers as finally installed in the Bucklin Point Sewage Treatment Plant in East Providence, R. I. Control can be automatic and proportional to flows of the plant influent flumes.

CHLORINIZER'S super-wide range pays dividends at Bucklin Point Sewage Plant

Two Builders Chlorinizers were placed in service by the Blackstone Valley Sewer District Commission over a year and a half prior to the completion of their Bucklin Point Sewage Treatment Plant at East Providence, R. I. These Chlorinizers — Model HCVS — were factory-equipped for super-wide range feeding . . . from 100 to 6000 lbs. of chlorine per 24 hrs. without changing orifices or meter scales. An interim disinfection program was instituted which took care of all sewage and wastes flows collected by the new interceptor system RIGHT FROM ITS FIRST STAGES — and charges could be levied against industries and municipalities as they tied in. Later, these same Chlorinizers were installed in the finished plant where they are now serving. Blackstone Valley Sewer District Commission reports the Chlorinizers have given completely satisfactory service both during the interim period and now that the plant is in full operation.

Find out why the trend is to Chlorinizer . . . for replacement, for plant expansion, for new projects. Write today for Bulletins to Builders-Providence, Inc., 350 Harris Avenue, Providence 1, Rhode Island.

CLARENCE V. HICKEY, OPERATING ENGINEER, SAYS:
"We've put Builders Chlorinizers to the test and they have stood up very well. These Chlorinizers have given reliable service for the past three and a half years . . . maintenance has been negligible. We have had no chlorine 'ice' troubles in cold weather and the Chlorinizers have been odor-free in operation."

BUILDERS-PROVIDENCE
DIVISION OF B-I-F INDUSTRIES, INC.
BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • OMEGA MACHINE CO.
METERS FEEDERS CONTROLS

"I'm proud to be a Savings Bonds salesman for Uncle Sam . . ."

CHARLES M. WHITE
President
Republic Steel Corporation

"I'm proud to be a Savings Bonds salesman for Uncle Sam and I urge every business executive in the nation to advance the cause of American enterprise in this way.

"Every one of us at Republic Steel is proud of the results of our Payroll Savings campaign: 96.7 per cent of our employees saving systematically from each pay in U. S. Savings Bonds. These results were possible only because all 68,344 of us at Republic were part of an enthusiastic team. We feel that this is the best way we can demonstrate our appreciation of the efforts to have a sound dollar and a stable economy."

• 96.7% of Republic Steel's 68,344 employees — over 66,000 men and women — are enrolled in the Payroll Savings Plan.

• These 66,000 members of Republic's "enthusiastic team," as Mr. White so aptly terms them, are investing more than $16,000,000 per year in U. S. Savings Bonds.

• In addition to building personal security, these men and women of Republic are making a very important contribution to America's "efforts to have a sound dollar and a stable economy."

Certainly Republic Steel's Payroll Savings record is outstanding — one of the best in the country. But it is not unique. Other companies have comparable records, measured in percentage of employee participation, or in annual Savings Bond purchases.

In every company with a high percentage Payroll Savings Plan you will find that the president or top executive appreciates the importance of the Plan and what it means to personal and national security. He knows that 45,000 companies have Payroll Savings Plans . . . that 8,000,000 employees of these companies are investing more than $160,000,000 per month in Savings Bonds . . . that the cash value of Savings Bonds held by individuals today is more than 36 billion dollars — and rapidly mounting, thanks largely to the steadily increasing family of Payroll Savers. He is 100% behind his company's Payroll Savings Plan, and everybody in the company knows it. He takes personal pride in watching employee participation grow to 60%, 70%, 80%, or, perhaps, the high 90's.

If you are not making this important contribution to America's effort for a sound dollar and a stable economy, a wire or letter to Savings Bonds Division, U.S. Treasury Department, Washington, D. C., will bring prompt cooperation from your State Director. He will show you how easy it is to join Mr. White and thousands of other executives as a Savings Bond Salesman for Uncle Sam, with a company Payroll Savings Plan that you can be proud of.

The United States Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

WATER & SEWAGE WORKS

MUELLER®

...assure simple, trouble-free operation!

Mueller "B" and "A-2" Drilling, Tapping and Inserting Machines use a single boring bar to drill and tap the main and insert the Corporation Stop. This guarantees accurate alignment, assures a uniformly tapped hole and eliminates the possibility of cross-threading the Corporation Stop.

A combination shut-off and by-pass valve arrangement in the machine permits the operator to check his progress at any point in the drilling, tapping and inserting operation. The use of this valve advises the operator before the machine is removed if the Corporation Stop is not tight or if the Corporation Stop threads differ from those in the main, or if other trouble exists. This trouble can then be corrected without a shutdown.

Both machines are used under pressure to remove and replace old Corporation Stops, drill, tap and insert new Corporation Stops and insert pipe plugs or to drill and tap dry pipe.

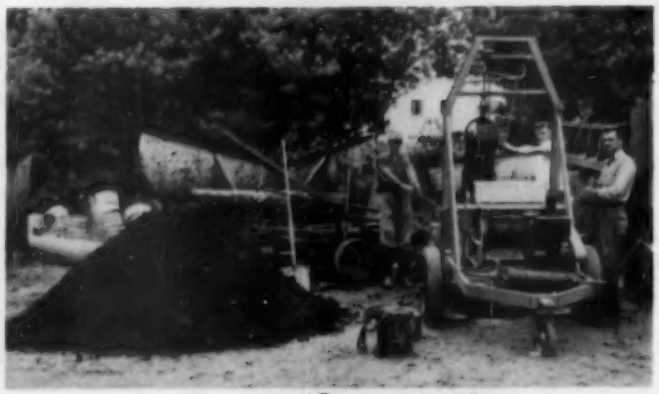
Consult your Mueller Water Works Catalog W-96, your Mueller Representative, or write direct for complete details and specifications on the Mueller "B" and "A-2" Machines.

MUELLER CO.

CUTTING SEWER MAINTENANCE COSTS WITH "Flexibles" AT LAPEER, MICHIGAN

Over 4 yards of sand just removed from the first 125 feet of trunk line in record time. No working at bottom of manhole; all deposits dumped at the street level. Just the start of an easy job that would have been tough *without* "Flexibles."

Sand, gravel, mud, rocks, roots, grease or slime–whatever your city's problems–"Flexibles" take them in stride, in all weather. For emergency cleaning or preventative maintenance, "Flexibles" are easier on the men–easier on the taxpayer. And there's a "Flexible" model for every requirement...budget or otherwise.



FREE DEMONSTRATION INVITED

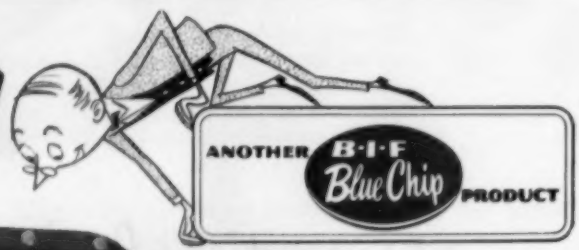
Flexible SALES CORPORATION

3786 DURANGO AVE., LOS ANGELES 34, CALIF.

(Distributors in Principal Cities)

AMERICA'S LARGEST LINE OF PIPE CLEANING TOOLS AND EQUIPMENT

What a Meter for Water!



BUILDERS PROPELOFLO is an inexpensive main line meter for totalizing water consumption. Gives dependable, trouble-free service on the job. Meters accurately over wide range — six-digit totalizer shows water use directly in gallons, cubic feet, etc. For complete information on this easy-to-install meter, write to Builders-Providence, Inc., 350 Harris Ave., Providence 1, Rhode Island.

BUILDERS-PROVIDENCE

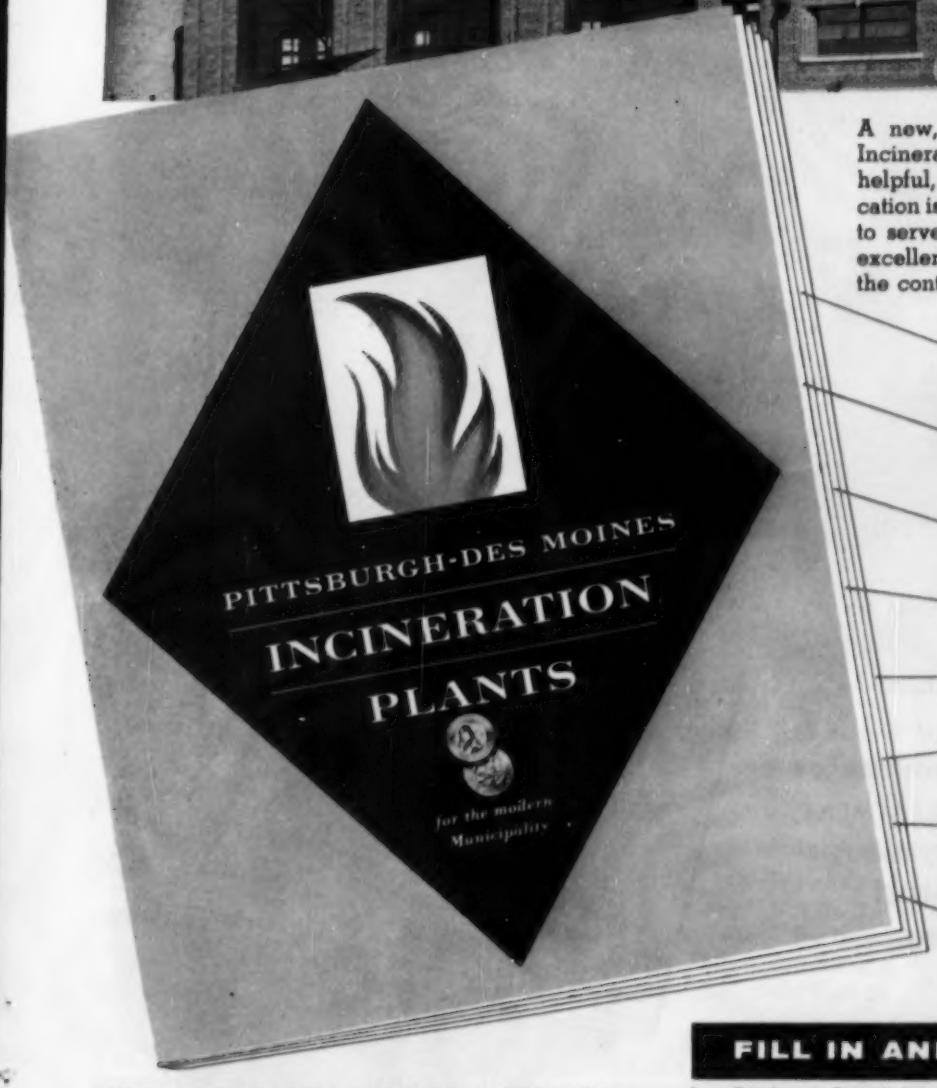
DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • OMEGA MACHINE CO.

BIF METERS FEEDERS CONTROLS

Ready for You Now!

Send for this free brochure on REFUSE INCINERATION for the Modern Municipality



A new, revised edition of our well-known Incineration Brochure, just off the press! This helpful, detailed, thoroughly illustrated publication is up-to-date in every particular—ready to serve your immediate interests, and with excellent reference value for your files. Note the contents—send for your copy!

- MUNICIPAL REFUSE DISPOSAL
- BASIC REQUIREMENTS OF A SATISFACTORY INCINERATION
- INCINERATOR DESIGN
- MODERN MECHANICAL STOKING
- CONSTRUCTION FEATURES
- PLANT TYPES
- SLUDGE INCINERATION
- MODERNIZATION OF EXISTING PLANTS

PITTSBURGH-DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

SALES OFFICES AT:

PITTSBURGH (25).....3418 Neville Island	DES MOINES (8).....919 Tuttle Street
NEWARK (2).....218 Industrial Office Bldg.	DALLAS (1).....1223 Praetorian Bldg.
CHICAGO (3).1222 First National Bank Bldg.	SEATTLE.....526 Lane Street
LOS ANGELES (48).....6399 Wilshire Blvd.	SANTA CLARA, CAL..625 Alviso Road

FILL IN AND MAIL TODAY!

Pittsburgh-Des Moines Steel Company
3418 Neville Island, Pittsburgh, Pa.

Gentlemen: Kindly send me a copy of your new 20-page Incineration Brochure, without obligation of any kind.

NAME_____

ADDRESS_____

CITY_____ STATE_____

TITLE_____

A World of Facts On

SUPERIOR COAGULATION!

Free Booklet—

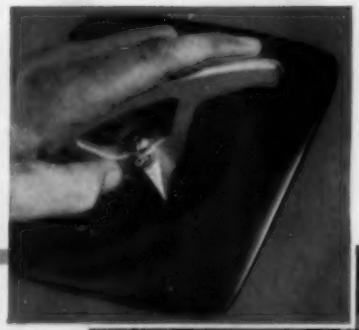
We want you to have a copy of this completely revised, up to the minute booklet that contains a world of information that will greatly assist you in problems you may have in **WATER TREATMENT, SEWAGE TREATMENT, INDUSTRIAL WASTE TREATMENT, SLUDGE CONDITIONING,** and other uses of Ferric-Floc.

Drop us a card for your copy of this booklet that contains valuable information for you.

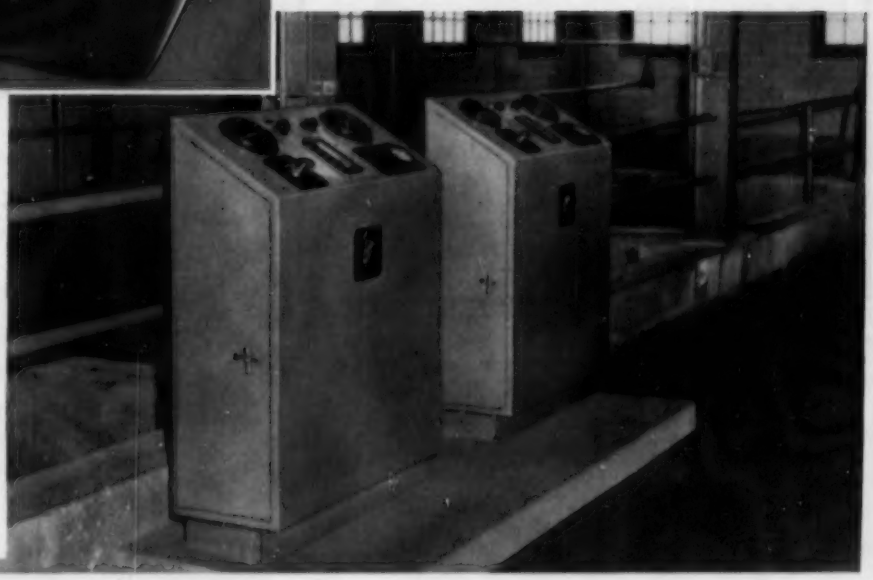
TENNESSEE TC CORPORATION

617-629 Grant Building, Atlanta, Ga.

A Snap to Operate... a Cinch to Maintain!



... Foxboro "Fingertip" Control for rapid sand filters



Two of four Foxboro Operating Tables which give operators complete control of four rapid sand filters in boiler-water treatment plant of Westvaco Chlor-Alkali Division, Food Machinery & Chemical Corporation, South Charleston, W. Va. In addition to operating table instrumentation, Foxboro panel instruments (not shown), control and record wash water level; record total effluent rate, loss-of-head, clear well level, and backwash rate. Consulting engineer: Sheppard T. Powell, Baltimore, Md.

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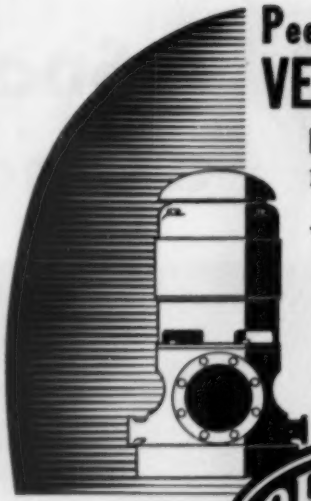

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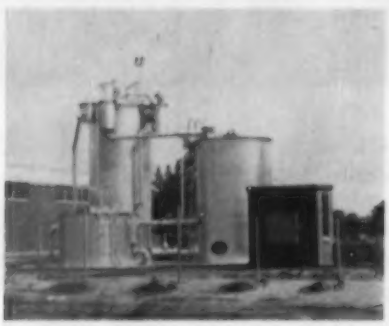

The tank at the left is a Spiragester, the tank to the right is a high rate filter, and the short tank in the foreground is a non-mechanized hoppered bottom final Spiraflo Clarifier. The plant handles the wastes from an ice cream manufacturing plant.

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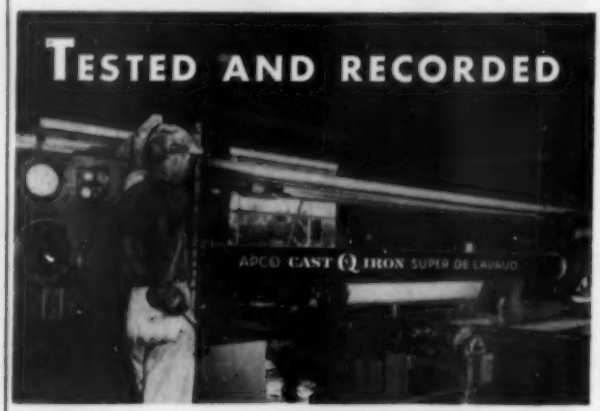

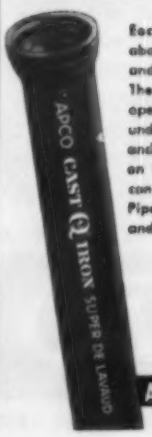

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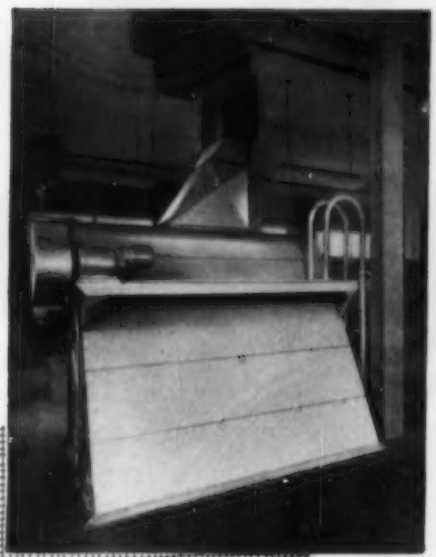

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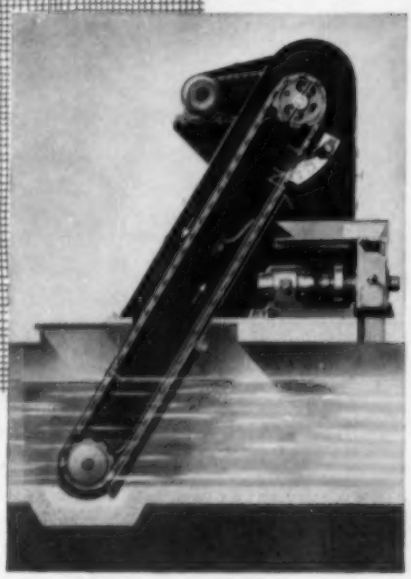

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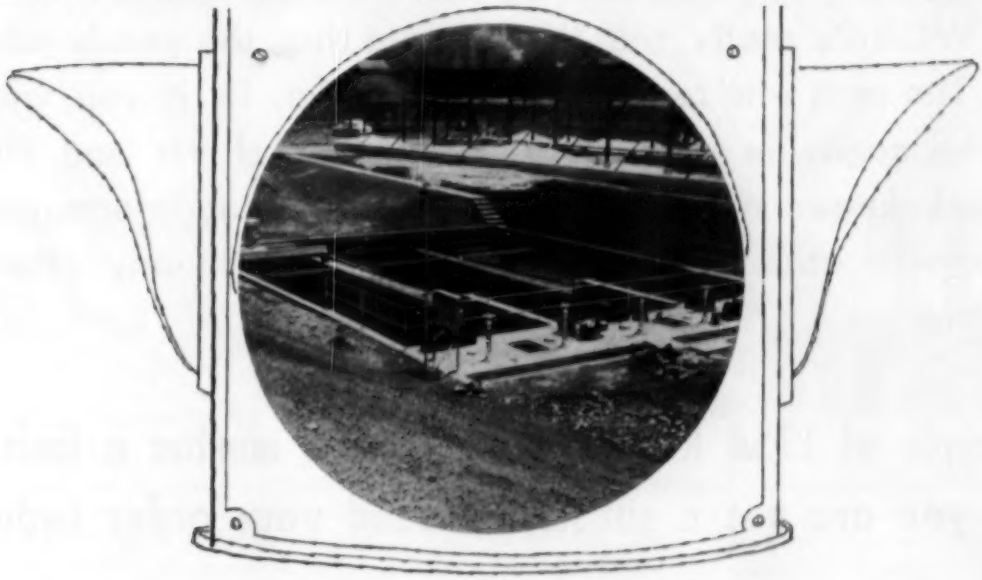
with PITT CHEM® Tar Base Coatings



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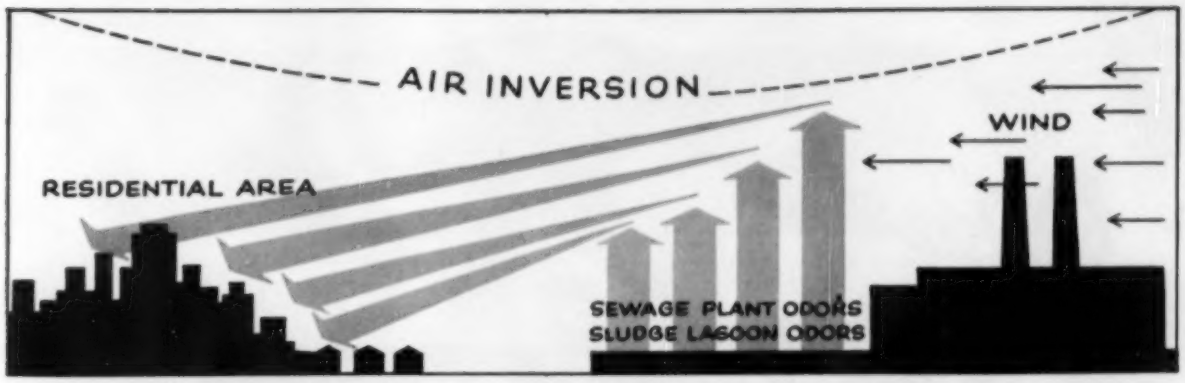

A multi-million-dollar sewage treatment plant was in trouble. Despite "care, cleanliness and chlorine," unpleasant odors were invading the homes of 30-thousand nearby residents.

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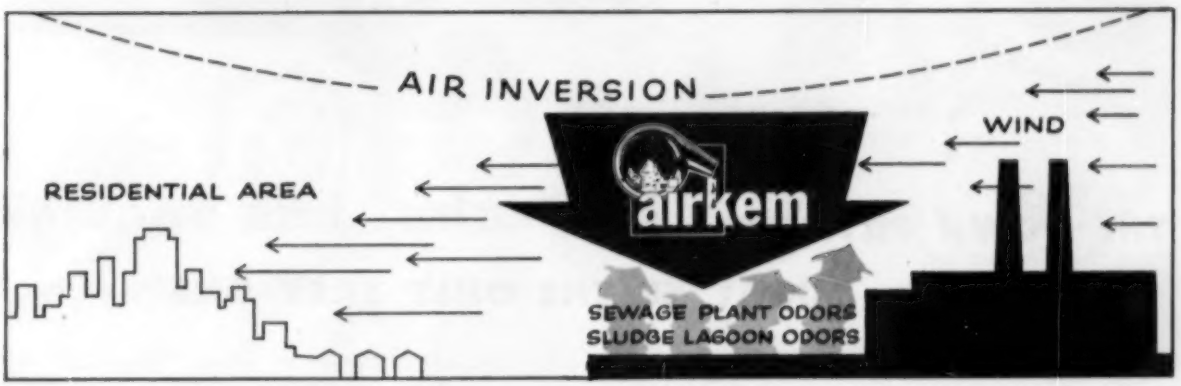

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WATER & SEWAGE WORKS

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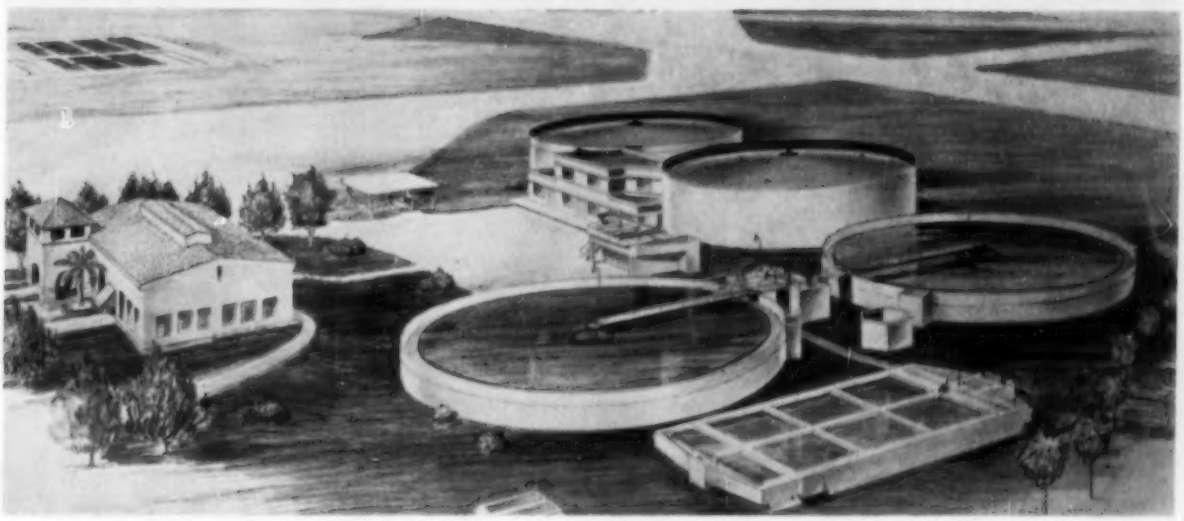


ST. PETERSBURG, FLA. Started operation of this new primary treatment plant during Florida F.S. & I.W.A. convention.

Sewage and Industrial Wastes in 1954

A Review of Problems, Trends, and Developments in Treatment

AUTHOR'S NOTE: In preparing the following article, I have resorted to methods which always have proved fruitful in the past and which again have proved their worth. I sent out an S.O.S. to my fellow State and Territorial Sanitary Engineers requesting that they furnish me with a brief resume of developments, problems and trends within their jurisdiction.

That my call was not in vain is borne out by the response of 42 out of a possible 48 replies. These, together with my knowledge of my own state, makes available to me firsthand knowledge of 87 per cent of the country extending from Alaska to Florida and from California to Maine.

This article is dedicated, therefore, to the State Sanitary Engineers of this country in grateful appreciation of their always available cooperation, kindness, and courtesy—and of the strong ties of mutual support which join us together.

D. B. Lee

by DAVID B. LEE

Mr. Lee is Director of the Bureau of Sanitary Engineering, State Board of Health, Jacksonville, Florida, and is the 1954-55 President of the F.S. & I.W.A. In compiling this annual review for *Water & Sewage Works*, he was assisted by John W. Wakefield, San. Engr. with the State Board of Health.

REPORTS received from all over the country, concerning progress in the sewage and industrial waste field, reflect to a large extent the character of the region from which they came. Reports from the older sections of the country such as New England, New Jersey, Minnesota, and Wisconsin reflect the fact that these areas already have well-developed sewerage systems and that the population is quite stable. The chief problems of these regions are extensions to match steadily increasing populations, modernization and replacements, and consolidation of small systems into larger districts and metropolitan areas.

The report of Alfred H. Fletcher of New Jersey is quite typical of the reports from State Sanitary Engineers. "The sewage treatment problem in New Jersey is chiefly one of additions and alterations to existing plants. Most of the approximately 250 sewage treatment plants in the state were built twenty or thirty years ago. The plants were adequate at that time, but many have become overloaded, obsolescent and inadequate because of a very unusual increase in population, age or industrial expansion."

Regarding trends in New Jersey, Mr. Fletcher states: "The trend in the densely populated highly industrial-

Dorr-Oliver Photo

EL CAJON, CALIF.—Has new compact activated sludge plant using Currie Clareator for aeration and clarification in a single unit.

ized northern part of New Jersey is toward more trunk sewers with central treatment works. Engineers are now planning and designing three such trunk sewer projects for the Bergen County Sewer Authority, to serve nineteen municipalities and industry; the Middlesex County Sewer Authority, to serve ten municipalities and major industry; and the Somerset-Raritan Valley Sewerage Authority to serve three municipalities and major industry."

Expanding Population and Industry

Conversely, many areas of the country, previously rural and semi-rural in character, are rapidly expanding both in population and industry into highly developed urban areas. My own State of Florida is in the vanguard of that group. While population growth has been rapid for twenty-five years, growth since World War II has been phenomenal. For example; the Bureau of Vital Statistics of the Florida State Board of Health estimates that Florida's population has grown more than 48 per cent in the past eight years.

This group of states which includes Florida, parts of Georgia and Kentucky, Iowa, Indiana, Kansas, New Mexico, Texas, Arizona, California, Oregon and Washington, reports that their No. 1 headache is providing adequate sanitary facilities for fringe areas. Edward Reinke of California, for example, reports: "Subdivision sewage disposal is a continuing problem throughout the state because the lands being subdivided generally are not satisfactory for individual home disposal units; the areas are not adjacent to communities having adequate sewerage systems; small sewage treatment and disposal units for a single subdivision are expensive to operate; and no adequate system of maintenance and operation has been developed in this state." More than 14 of the 43 states reported on herein reflected similar problems.

How Problems Can be Solved

However, that the problem *can be solved* is borne out by our own experience here in Florida and by that of states such as Kansas, of which Dwight Metzler reports: "—Eighteen new municipal plants have been completed this year and 23 more are under construction at this time. In the six years preceding this year 114 new municipal plants have been built in Kansas.

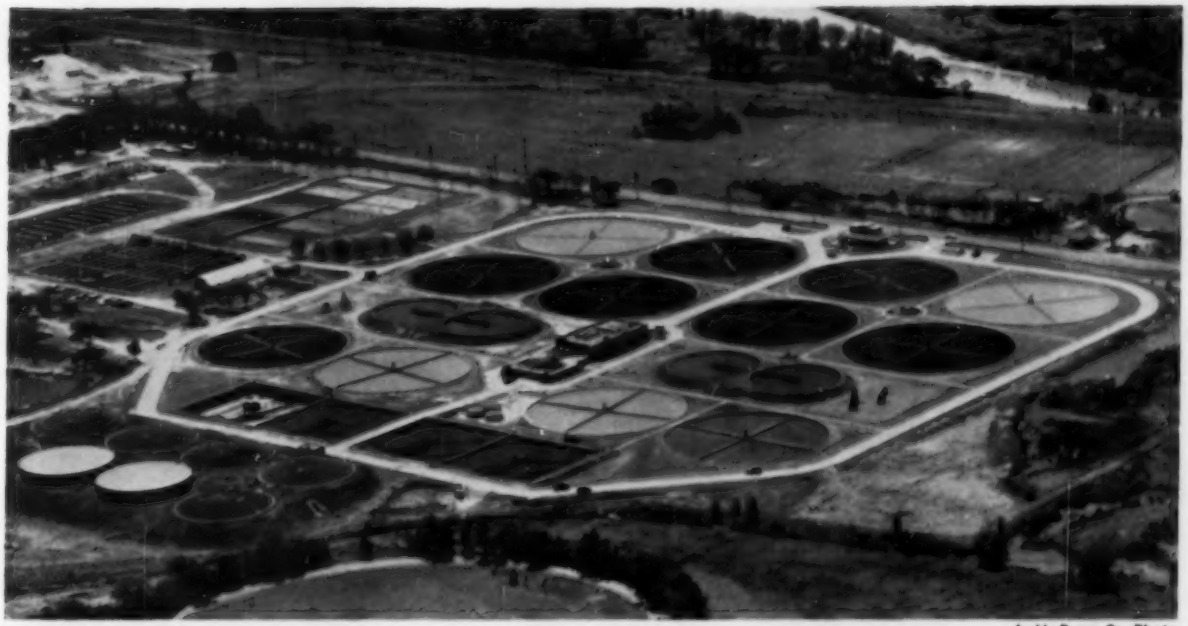
"The development of sewer districts in urban areas, which are largely unincorporated, continues to be a problem. Both large and small housing developers are operating at top speed, particularly in the Kansas City, Topeka and Wichita areas. Our policy of refusing to approve individual septic tanks has done much to promote the orderly growth of public sewer systems."

In Florida, due to peculiar tax laws, consolidation of subdivisions with cities has not been a satisfactory solution to the fringe area problem. By following similar methods, however, Metzler indicates privately owned and operated sewerage systems have been developed for subdivisions ranging from 40 homes (septic tank-sand filter) to 10,000 homes (complete activated sludge). The works are financed in part by increased evaluations of the property and in part by sewer rentals, preferably by relating administration of sewer rentals to the public water supply. Since January 1, 1954, 27 subdivision systems have been placed under construction and 10 sets of plans for such systems are awaiting approval at this time.

Pollution Control is Effective

A third group of states, overlapping to some extent the other two groups, reports a high level of activity both in sanitary sewerage and industrial waste developments—due to an aggressive water pollution control policy.

Michigan and Ohio probably are the leaders of those reporting in that group. Arthur N. Corcoran, Sanitary Engineer of the Michigan Water Resources Commission, furnished a copy of a paper entitled "Pollution, Progress and Problems," which was presented by Milton P. Adams, Exec. Secy. of the Water Resources Comm. before the Michigan United Conservation Clubs in June, 1954. Mr. Adams states in part: "It will be noted that the total number of projects in the two municipal listings will represent an investment of more than 34 million dollars. When the total industrial investment over the same period is added, probably as much as 45 million dollars will have been expended by cities and



A. M. Byers Co. Photo

OKLAHOMA CITY, OKLA.—Southside treatment plant (above) is part of this city's $9 million solution to sewage and waste problems.

industries in little more than this two-year period. This is to gain improved quality for you and other users of Michigan's water resources. It takes big money to erase past and current inroads of sewage and industrial waste —and much is still to come.

"Suffice it to say there has never been a time in Michigan's history when plants and facilities for the control of water pollution were going forward in so many parts of the state as they are right now!

"Successfully prosecuted state litigation resulting in court orders against 11 municipalities and 1 industry have supported the above record. Additional municipal defaults declared by the Commission and referred to the Attorney General for appropriate action number 12. Of these, decrees have been obtained in recent months at Cheboygan, Frankenmuth, Croswell, Farmington, Boyne City, Roscommon and Harbor Beach where construction will be under way in due course. Complaints have been filed in the appropriate courts for St. Clair, Marine City and Ironwood. Complaints are in preparation for Benton Township of Berrien County and Algonac.

"We believe you will look in vain for any comparable record of enforcement effort in all of these United States. It's true, of course, most of these decrees aid or will aid the municipalities involved in financing their respective projects under the provisions of Act 320, Public Acts of 1927."

Ohio's G. A. Hall, Engr.-Secy. of the State Water Pollution Control Board, reports that as of July 1954, there were only 40 cities and 43 villages over 2000 in population without treatment works, and that all of the cities and most of the villages have taken positive action toward correcting these conditions. He also reports that of 560 industries under waste-discharge permit at the end of 1953, 26.7 per cent have adequate facilities, 32.8 per cent are definitely inadequate, and 40.5 per cent have no treatment facilities.

Of the 560 industries, 24 have new or improved facilities under construction, 232 are working on plans, 140 are making preliminary studies and only 15 are reported to have taken no action. Mr. Hall modestly states, "In general, we would note that Ohio has experienced an acceleration in progress toward stream clean-up, both by industry and municipalities. This reflects the activities of the Water Pollution Control Board which came into full effectiveness in 1952."

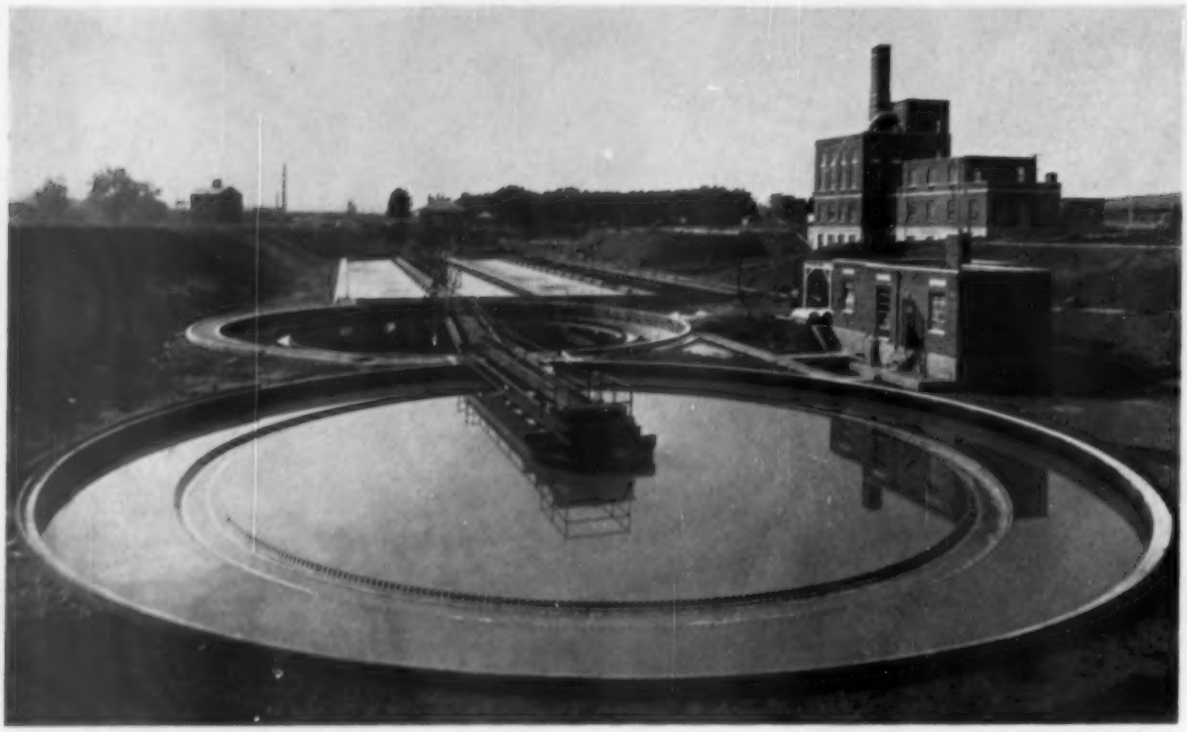
Financing is Universal Problem

An almost universal problem is that of financing sewerage systems, especially for smaller communities. In many cases, bonded debt limitations have eliminated general obligation bonds as a source of funds. The unproved worth of sewage rental revenue, coupled with the high cost of sewage treatment facilities, makes financing of small installations very difficult. There is, however, a definite trend toward direct assessment for the lateral sewers and sewer rental charges for plant construction and operation. A need appears evident for better education of the public that sewerage is a utility and should be treated as such.

Our own experience indicates that the average citizen is in many cases more forward thinking than the city officials. We are convinced that, if the public is properly informed, any reasonable request for funds for sewerage improvements, including ad valorem bonds, will be supported by the voting public.

Missouri's Clifford L. Summers, Assistant Chief, Waste Disposal and Stream Sanitation, states, "—We conservatively estimate that construction now in progress represents a monetary value of $18,000,000—. We are extremely proud of the fact that only two bond issues for sewage works have failed during the past eighteen months."

The cost of sewage treatment facilities, and the difficulties of financing these facilities in smaller communities, has been instrumental in the development of oxidation ponds or lagoons as methods of sewage treatment in many parts of the country. The states of North and South Dakota, Colorado, Montana and Wyoming report very intense interest in the use of lagoons, with the Dakotas and Montana reporting that practically all new sewage treatment plants in their states will include lagoons either as secondary treatment devices or for the treatment of raw sewage. A number of the midwestern, southwestern and far-western states also reported interest in lagoons for use by the smaller towns and



Hardinge Co. Photo

YORK, PA.—Two 100-ft. circular clarifiers in new activated sludge treatment plant which includes sludge digestion and chlorination.

cities. In general, oxidation ponds and lagoons are of interest throughout the areas of limited rainfall.

Several southern and southwestern states reported problems of odor control due to flat sewer grades and high temperatures. Conspicuous by its absence was any comment on the use of so-called "bio-catalysts" to correct such conditions which there has been much activity on the part of manufacturers of these products during the past year. The state sanitary engineers apparently did not consider use of these materials worthy of comment.

One state (Kansas) reported difficulty in the separation of supernatant from single-stage conventional digestors and stated the trend there to be toward two-stage digestion. It appears probable that the digestion of sludge presents more of a problem than has previously been recognized. Several states report modifications in the digestion process, such as the use of coil filters for raw sludge, and the installation of drying beds that can be flooded to a 2-ft. depth (these beds have a skimming device to remove free water on the surface of the sludge).

Dorr-Oliver Photo

DURHAM, N.C.—To reduce load on old trickling filter plant, new vacuator and grit washer units have been installed at new Hope Creek plant.

Industrial Waste Problems

The most commonly reported problem with industrial waste concerned the discharge of toxic wastes, such as cyanides and chromates, into either sanitary sewer systems or into surface streams. A number of plants have been constructed to treat such wastes, and control measures are being taken to detect and limit the discharge of excessive quantities of these materials into either two sewers or the streams.

A number of states, particularly in the northwest, report problems involving oil refinery wastes. Wyoming's Director of Environmental Sanitation, L. O. Williams, for example, reports that discharges from an oil refinery and from the City of Casper affect the quality of the North Platte River for a distance of 50 miles below the point of discharge. Progress is being made in corrective measures, in this case and elsewhere, generally by

Walker Process Co. Photo

DAYTON, OHIO—Impingement aeration installation of 110 air-and-water jets in four pre-aeration units, each 155 ft. x 30 ft.

using API separators followed by biological treatment.

Food processing is by far the most widespread industry in which treatment of wastes is required. Included in this industry are canning plants, slaughter houses and milk processing plants. Seasonal cannery waste discharges constitute a continuing problem of state sanitary engineers. Lagooning has been the most common method of handling these wastes. While lagoon treatment has proven fairly successful in the colder states with short harvesting seasons, it has been found unsatisfactory in states such as California, Texas and Arkansas where (like Florida) seasons are relatively long and where high temperatures aggravate odor problems. In Florida, citrus canning, particularly frozen concentrate canning, has become a major industry processing more than 84,000,000 full boxes of citrus fruit over a seven months harvesting season.

Uses for Spray Irrigation

A number of states including New Jersey, Ohio, Illinois, Indiana and Arkansas report the increased use of spray irrigation for disposal of cannery wastes, and in some instances for disposal of dairy and slaughter house wastes. F. L. McDonald, Chief Sanitary Engineer of the Arkansas State Board of Health, describes one vegetable canning plant where, after multiple screening, 250 gallons per minute of liquid wastes per 8-hour day are pumped to movable spray distributors located in a 40-acre alfalfa field.

He reports "The alfalfa field, fence and premises are well maintained. The area is somewhat of a showplace on a heavily traveled national highway. There has been no odor problem in connection with this disposal method during the two years it has been in operation.

"This spray irrigated field produced five heavy crops of alfalfa during each of these severe drought years, as compared to two fair crops produced on non-irrigated fields in the same area.

"It is understood that the income from hay grown on the irrigated field is sufficient to pay for the total cost of disposal of this heretofore troublesome industrial waste."

Limited experience with spray irrigation for citrus waste treatment in Florida was not so successful. The waste normally has a pH of 3.5 to 4.0 but have a pH as high as 10.0 during clean-up periods. When the waste was sprayed in a wooded area, small vegetation promptly died and even the larger pine trees eventually were killed. Lack of suitable areas near existing citrus canning plants has discouraged further experimentation; with pH-controlled wastes, spray irrigation might be successful.

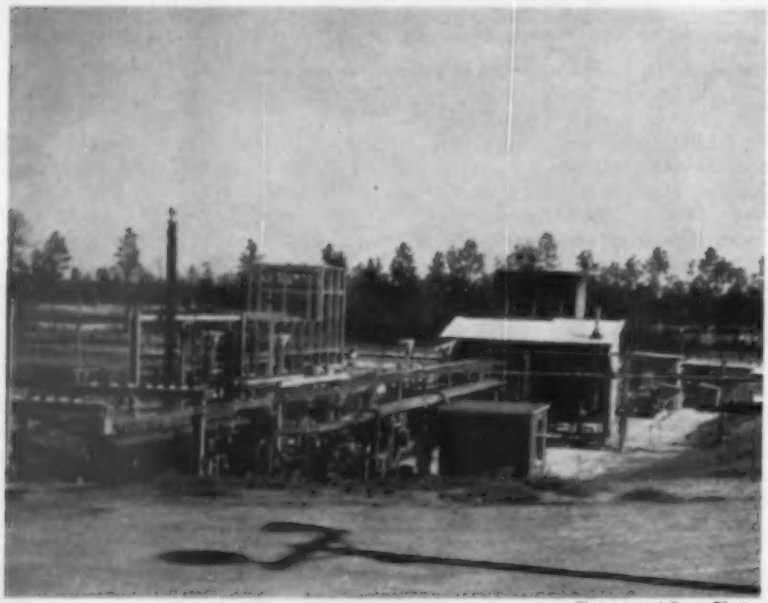
TABLE 1

National Container Corporation, Valdosta, Georgia
Kraft Mill Effluent Treatment

	Surface Elevation, Feet	Approx. Size, Acres	Average Depth, Feet	Volume in Acre Feet	Volume in Mil. Gal.	Theoretical Detention, Days A	B
Strong Storage Basin.....	185.0	87.5	4	350.0	114.10	57	—
Settling Basin	186.5	7.2	5	36.0	11.74	3	2
No. 1 Oxidation.....	186.0	50.0	3.5	175.0	57.05	14	10
No. 2 Oxidation.....	185.0	195.0	4	780.0	254.28	64	42
First Storage (Stokes)....	173.0	44.0	7.5	330.0	107.58	27	18
Second Storage (Carroll)	99.5	62.5	4	250.0	8.15	20	14

Alaska Health Dept. Photo

KETCHIKAN, ALASKA—Pulp plant uses new process to reduce pollution.



Chemstrand Corp. Photo

PENSACOLA, FLA.—Chemstrand incinerators, one in service, one under construction.

Laboratory experiments and pilot plant studies in both Florida and Texas indicate that citrus waste can be treated by activated sludge or by trickling filters. Study of these methods is being continued.

Increasing Industrial Cooperation

Many states report an increased readiness on the part of industrialists to carry their fair share of the water conservation program; industrialists show greater readiness to cooperate with regulatory agencies and with each other in seeking equitable solutions to existing problems. Georgia's W. H. Weir, Director of Water Pollution Control, called attention to this cooperative trend in discussing a recent conference of southern pulp and paper manufacturers in New Orleans.

Weir reports, "At that meeting four companies took pride in describing what they were doing or had done to control pollution. Compare this attitude with the former reluctance of companies to 'let the cat out of the bag' for fear of putting some other lagging mill on the spot."

Mr. Weir refers particularly to results reported by W. T. Webster of National Container Corporation. This firm has placed in operation at Valdosta, Georgia, a mill which discharges waste into a stream in Florida! By virtue of good site selection and prior planning, the B.O.D. of the mill waste is reduced (through a system of lagoons in series) by more than 90 per cent prior to discharge of the effluent into the stream. The addition of about 6 mgd of effluent from this source was sufficient to maintain more than the minimum allowable dissolved oxygen content in the stream during recent drought periods, when the stream flow of 65 sec. ft. was below the previous 35-year minimum.

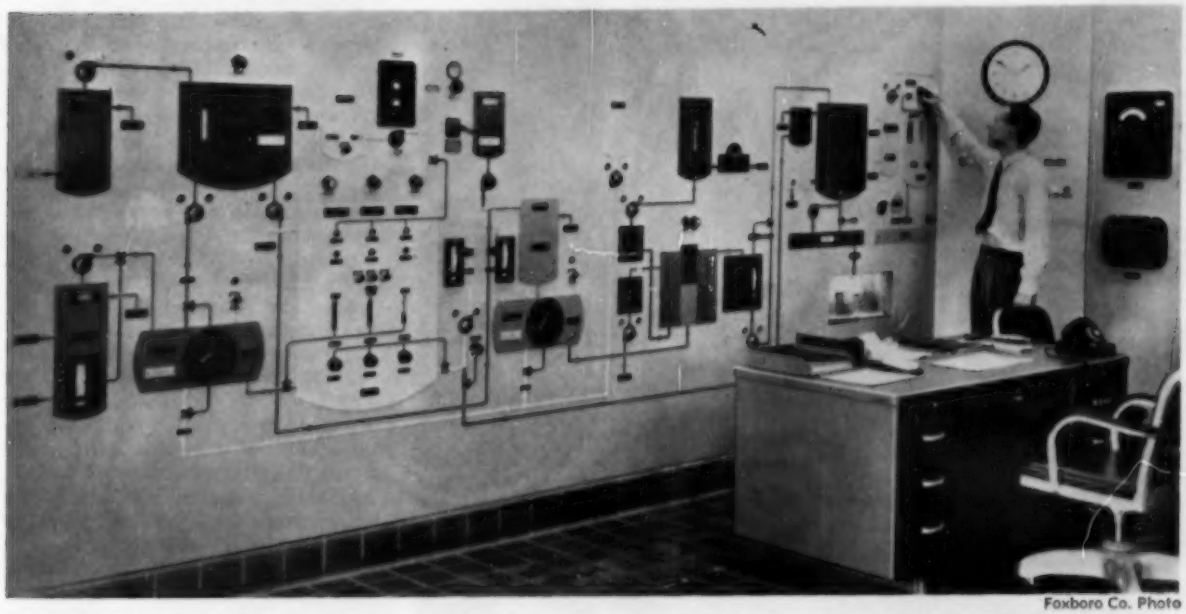
Mr. Webster noted that these waste treatment facilities, including the purchase of land, cost his company about $500,000.00. Some conception of the treatment process and the utilization of topographical features can be obtained from table 1.

Treating Paper Mill Waste

Paper and pulp mill waste also presents a treatment challenge that is being successfully met in Alaska, New Hampshire, Washington and Oregon. Both Alaska and Washington report sulphite mills in operation, utilizing magnesium-base chemicals with evaporation and burning of the strong sulphite liquor to recover the chemicals for re-use. Washington also reports one sulphite mill evaporating and burning all waste liquor from ammonia-base cooking, while another manufactures alcohol and lignisite.

New Hampshire reports sulphite liquor treatment still poses a major problem. One mill, that of The Brown Company, Berlin, New Hampshire, has completed pilot studies of a process utilizing sulphite waste for the recovery of furfural. It has been estimated that a full-scale installation, together with burning of the wastes remaining after furfural recovery, would eliminate 80 per cent of the waste load discharged to the river.

Oregon and Washington also have sulfate mill waste treatment problems. Three of the Oregon mills utilize lagoons to hold the waste during periods of low stream flow. One Washington mill mixes pulp waste with bleach waste to destroy sulfides and mercaptans prior to lagooning, and



Foxboro Co. Photo

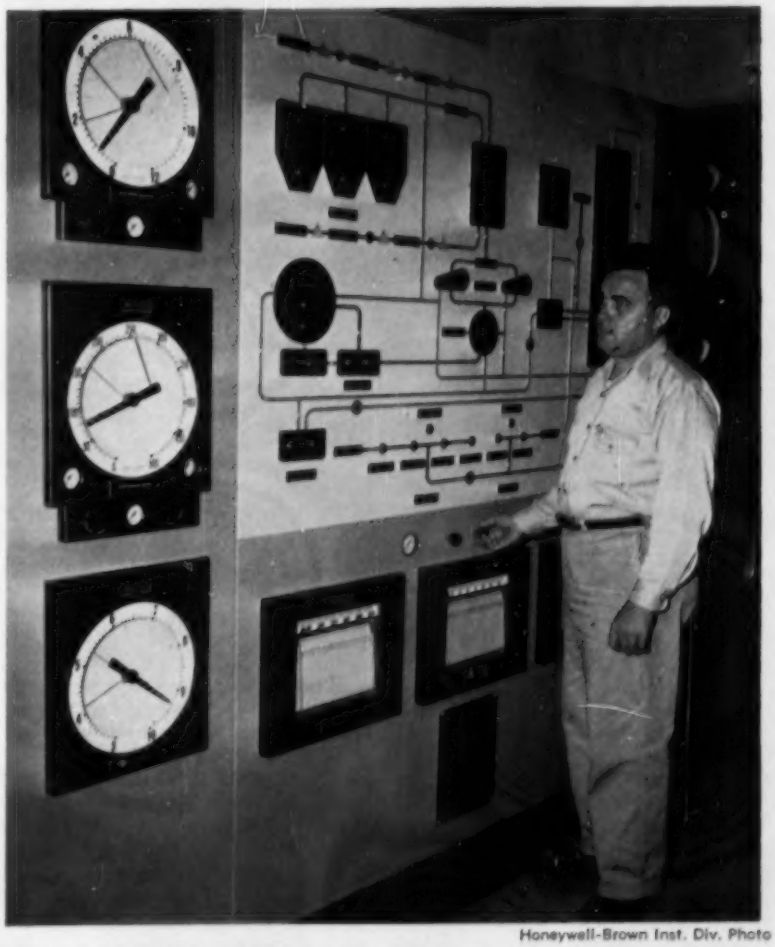
INSTRUMENTATION—Cyanide waste treatment plant of Oneida, Ltd., plant at Oneida, N. Y., has central graphic control panel.

discharges the effluent to Puget Sound on an outgoing tide. Other Washington kraft mills utilize multiple outlets for dispersion of waste in the main channel of the Columbia River.

Chemical Manufacturing Waste

Many writers have reported on the rapid growth of the chemical industry in the U. S., and on the industry's waste treatment problems. In this category are synthetic fiber plants, one of the newest of which is the Chemstrand Corporation plant located near Pensacola, Florida, on the Escambia River. This plant discharges an estimated 44,000 lbs. of 5-day B.O.D. into the stream, but the stream is adequately protected by holding strong liquid wastes in lagoons during low stream flow, by evaporating and incinerating more concentrated wastes, and by drying filter cake in a special lagoon.

Separate ponds are provided for holding neutral and acid wastes to prevent odors. When the stream is at normal flow, effluent from both ponds is discharged to blend with large quantities of cooling water before discharge into a bayou. The bayou is provided with a skimming device near the outlet. A continuous sampling program, using automatic pH recorders, applies both to the wastes and to the receiving stream as protection against accidental spills. The program is planned so that gradual deterioration of stream quality cannot go unnoticed.

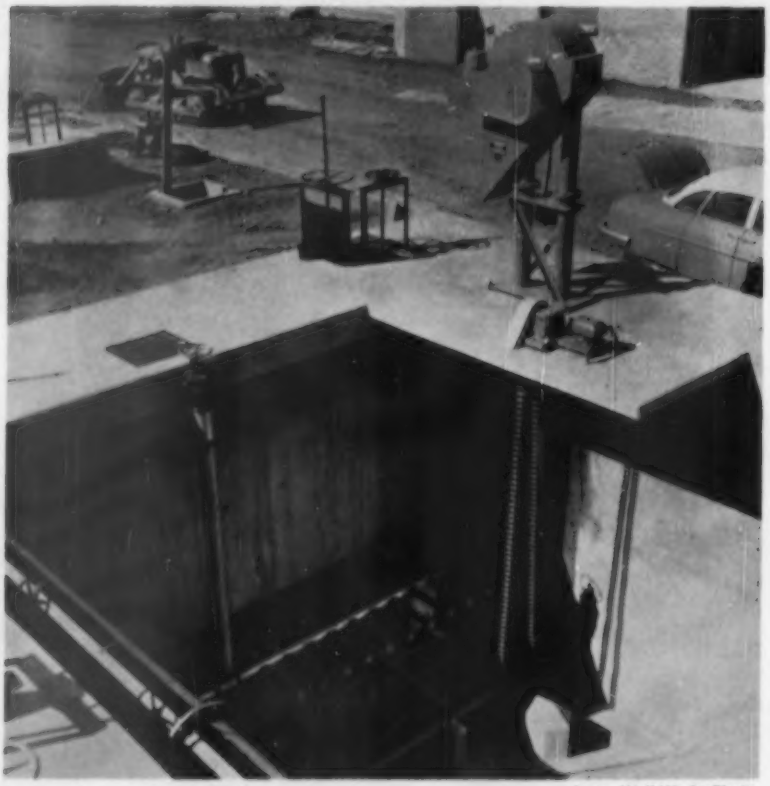


Honeywell-Brown Inst. Div. Photo

MORE INSTRUMENTATION—New $1.5 million sewage treatment plant for Fairfax County, Va., has colorgraphic central control panel. Below are Electronik potentiometers with Air-O-Line controls.

Electric Machinery Mfg. Co., Photo

WORCESTER, MASS.—Unattended pumping station. When power fails, standby Diesel generator starts three pump motors, to prevent pollution of nearby lake.



Amer. Well Works Photo

ENID, OKLAHOMA—One of two grit removal tanks, with collector, elevator, preaeration unit, and rotary skimmer in new activated sludge sewage treatment plant.

Important Small-Volume Wastes

There is a large group of industrial or semi-industrial waste contributors that seldom receive the attention they deserve. Included in the group are tourist courts, motels, trailer courts, restaurants, bars, launderettes, drive-in theaters, dairy and ice cream bars, and shopping centers located on the fringe of every large city beyond the reach of public sewerage systems. Because individually the amount of waste contributed is small, the average consulting engineer or researcher tends to underrate the importance of these problems. A public health engineer, on the contrary, will testify to the aggregate magnitude of these many small individual problems, and to the technical difficulties involved in the disposal of these wastes.

Waste treatment facilities to serve these establishments must be sufficiently simple to operate with only periodic attention, must provide a quality of effluent suitable for discharge (if necessary) to a roadside ditch, and must be low enough in first cost to match the size of the installation it is to serve. Batch chemical treatment for laundry waste, and grease traps with underground drain fields for restaurant waste, have proved ineffective—due to their requirements of close attention and frequent maintenance. Flotation equipment is now manufactured by a number of firms for small scale treatment and is applicable where the installation is of sufficient size to justify the expense. High rate trickling filters are now being studied for treating wastes from small laundries; indications are that these may prove more effective than sand filters. The rapid clogging of sand filters by greasy wastes has been demonstrated in numerous installations.

Recent trends toward large shopping centers located in suburban areas will have the effect of combining a number of wastes into a volume large enough to justify conventional waste treatment methods. One such center, will have a waste load of about 20,000 gallons a day; the waste will be treated by means of an Imhoff tank and high rate trickling filter before discharge to a small creek.

Tourist courts and motels, at least in the southern half of the country, are developing into establishments of considerable magnitude. Courts of from 24 to 50 units have long been in operation but, in the more highly developed tourist centers, recent trends have been toward larger and more elaborate cottage and apartment hotels ranging up to complete facilities for 1240 guests. The waste from this type of installation is, of course, amenable to treatment by conventional methods. Space requirements, the need for effective odor control, and pleasing architectural treatment, are factors presenting a challenge worthy of the best engineering in the field.

Research and Development

In research and development there has been a very definite trend toward less costly and less complex waste treatment procedures and devices. The growing use of seepage, evaporation, and oxidation ponds in the drier portions of the country is a manifestation of the struggle to provide satisfactory and economical waste treatment—particularly for smaller communities.

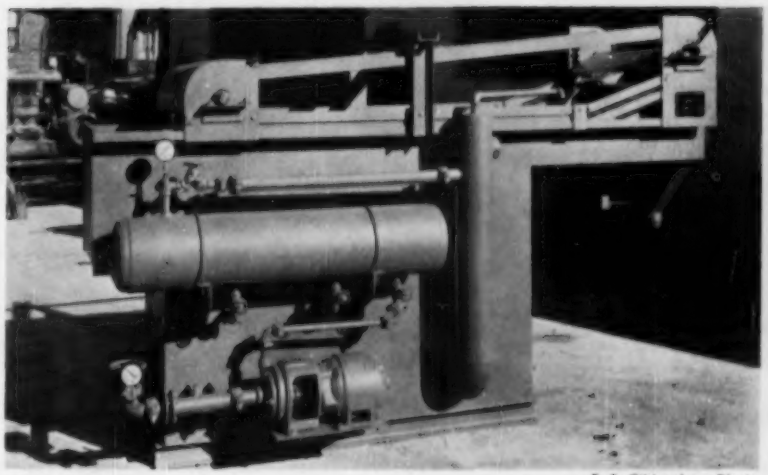
Modifications of sludge digestion methods, to allow greater loadings per unit of volume, have been under study for several years. Manufacturers now have on the market equipment and methods which are claimed to materially reduce the digestion period and thus allow much higher unit loadings. These modified methods were the subject of the most controversial debate at the recent Cincinnati convention of the Federation of Sewage and Industrial Wastes Assns. Wilbur N. Torpey, Senior Civil Engineer, Dept. of Public Works, New York City, touched off the fireworks with a discussion of pilot plant tests made at the Ward's Island plant. These tests indicated that, by control of mixing and temperature factors, storage of sludge could be reduced to as little as 0.2 cu. ft. per person. On the basis of these tests, New York is designing a full-scale digestor to provide on 0.5 cu. ft. per person storage.

Harry E. Schlenz, President, Pacific Flush Tank Co., cautioned against accepting such high loading rates until more conclusive experiments could be performed and especially against their use in smaller communities. Dr. H. Heukelekian of Rutgers Univ. agreed that extreme loadings were not for smaller communities, but urged an open mind toward the new development in order that progress could be made.

For the complete treatment of wastes, shorter treatment periods also have received study; full-scale plants utilizing some of the new principles have been installed. The Ward's Island experiment with "activated aeration," wherein excess sludge from a conventional activated sludge plant was utilized for intermediate treatment of sewage in an aeration tank is a case in point. In that experiment, the aeration tank operated in parallel with the activated sludge plant but with considerably lower air requirements.

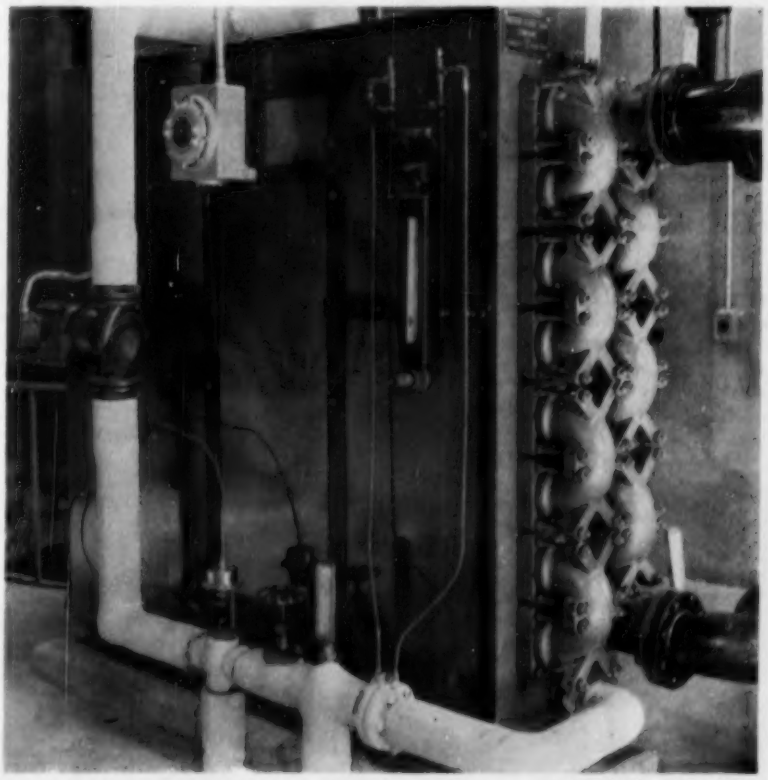
Secondary Treatment—Increased Loading

Both Oklahoma and Texas report full-scale plants in operation utilizing Infilco's patented Biosorption process utilizing a separate "sludge stabilizer" tank. This process builds up activated sludge which is then mixed intensively with raw sewage for 35 minutes, prior to two hours settling in a conventional clarifier. Air requirements are about the same as for conventional activated sludge. The developers state that a full-scale 7 mgd plant at Austin, Texas, averaged better than 90 per cent B.O.D. reduction.



F. S. Gibbs, Inc., Photo

BUTLER, N. J.—This flotation unit is in operation at American Hard Rubber Co. manufacturing plant to remove rubber fines from industrial waste water.



Pacific Flush Tank Photo

NAUGATUCK, CONN.—Modern shell-and-tube heat exchanger provides temperature control for digesting sludge in the city's new sewage treatment plant.

Trickling filters came in for a share of inovations. Wyoming reports on an installation using a loading somewhat higher than usually considered acceptable for low rate trickling filters, but using a relatively high recirculating rate of 2.5 to 1 at design load. Supernatant from the digester is re-aerated, and is fed to the trickling filter during periods of low flow to avoid reduction in zoogleal activity during periods of low B.O.D. The developers of this process expect a reduction of 92 per cent in B.O.D. to be accomplished. In the raw sewage, the B.O.D. value ranges from 350 to 550 ppm.

Even primary treatment can be improved. The City of St. Petersburg, Florida, has only recently placed in operation a new primary treatment plant; this includes a chlorine contact chamber, equipped with a mechanical sludge and scum removal

U. S. Pipe & Foundry Photo

NEW LONDON, CONN.—Pontoons support outfall sewer of 30-in. flexible joint CI pipe. Threaded rods lower the pipe.

Price Bros. Co. Photo

MIAMI, FLA.—Dredge lays subaqueous force main of 72-in. reinforced concrete steel pipe in 32-ft., 32-ton, sections.

mechanism. The engineers feel that this equipment will not only reduce the chlorine demand (by preventing sludge deposits) but also will prevent unsightly grease accumulations on the surface.

Effluent Use and Re-use

The drier sections of the country report continued interest in re-use of wastes for irrigation or to replenish depleted ground water supplies. California in particular has been carrying on extensive research with these aims in view. One approach being investigated is the use of an oxidation pond to polish a previously treated waste prior to re-use. In connection with this project, the possibilities of growing algae as a source of protein, or possibly for fuel, are under investigation.

Research and development to reduce the cost of industrial waste treatment is likewise at a high level. Mention has been made of the extensive use of industrial waste for spray irrigation. A number of states also report determined efforts on the part of industry to reduce the amount and strength of industrial waste by in-plant changes and good housekeeping.

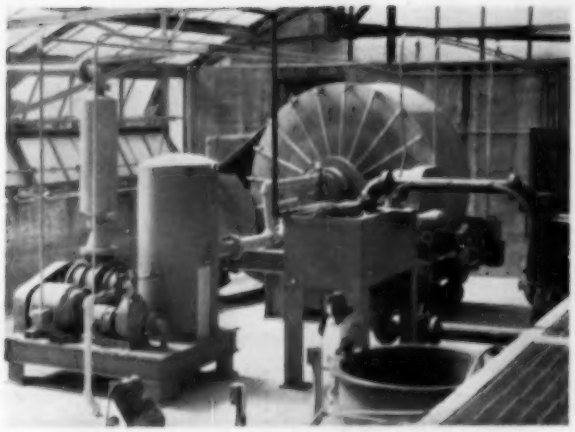
The State of Colorado reports a new twist to the old program of combined sanitary and industrial wastes. A large brewery has constructed and is operating a waste treatment plant to treat not only brewery wastes but also the wastes from the community in which it is located. That would seem to be the ultimate in cooperation by industry!

Future Problems and Needs

That solutions have not been found to all our waste problems is evident from the reports of the several states. The most universal need is to stretch available dollars to cover water pollution requirements or, conversely, to find more dollars. This need is being vigorously attacked from both angles, but will never be completely solved.

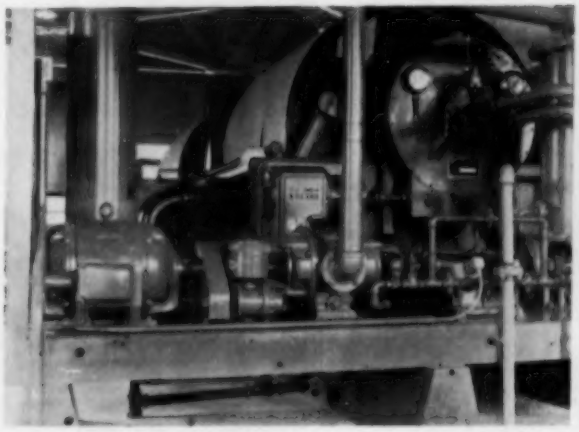
The application of revenue bond issues supported by sewer rentals, with or without direct property assessment, is becoming more wide-

MIAMI, FLA.—Compact trickling filter—separate sludge digestion plant of new Golden Gate Motel depends on preclorination for odor control.



Komline-Sanderson Eng. Corp. Photo

MT. PENN, PA.—New 100-sq. ft. Coilfilter for dewatering sludge is installed in greenhouse (formerly a covered bed).



EAST HARTFORD, CONN.—Compact two-unit vacuum filter installation in this city's new sewage treatment plant.

spread. At least one state, Pennsylvania, recognizes that the entire state benefits by water pollution control, and on that basis makes state grants to cities accomplishing satisfactory waste treatment.

Two or three states have suggested federal grants or loans to stimulate municipal construction of water pollution control structures, similar to the Hill-Benton Act for hospital construction. This procedure, however, seems hardly necessary if the people can be convinced that sanitary sewerage is a utility of special benefit to those served by it, and if they can be convinced that the utility is of general benefit to the entire community.

It is very evident that many areas of the country are in need of a new approach to the "fringe area" problem. Country-wide sewerage authorities or metropolitan districts appear to provide the best answers. In any case, long-range planning and development are urgently needed to serve adequately newly developed areas and to integrate the many parts into a whole system. Legislation is needed in most states, so that public health officials can require adequate sanitary facilities before new subdivisions are created.

Administrative Requirements

Neither more public money, nor cheaper waste treatment facilities, will solve our industrial waste problems. Two administrative steps are necessary for a uniformly good industrial waste program. The state must have legislation permitting equitable use of available streams, under which industry can be required to provide satisfactory waste treatment. It is not reasonable to expect industry to do this work on a voluntary basis. The state and federal governments should recognize that waste treatment, while a part of production, does not in itself produce. Therefore, funds expended for treatment works should not be credited as capital gain or as increased property value for ad valorem taxes. Since the whole state again benefits from the work, it would appear reasonable to allow rapid amortization of funds spent for waste treatment with some relief through state and federal income tax levies. It is quite evident that the states with satisfactory industrial waste programs are those having strict but fair water pollution control laws that are vigorously enforced.

Finally, the administrative water pollution control agency, the State Board of Health or the Water Pollution Commission as the case might be, almost universally express a need for more personnel and more funds for salaries. An energetic water pollution control program requires an adequate staff to constantly visit, consult with, aid, and check on waste problems, as well as to survey the receiving streams. Impressive results have already been achieved, but complete protection and conservation of America's waters can be accomplished only when an enlightened public instructs enlightened officials to provide suitable laws and regulations. This action must first *encourage* pollution abatement, then *require* pollution abatement, and finally provide a regulatory agency with sufficient means to carry out its mandates.

W&SW

Correction: Coleman Joined De Laval in 1914

"Coleman and Quigley Honored by De Laval for Long and Distinguished Service" was the headline of a release on page 41 of our January issue. It stated that Charles E. Coleman joined De Laval in 1919.

Mr. Coleman joined the firm in 1914, according to a corrected report we have received. For veteran Charles E. Coleman we are pleased to correct the record and to note the additional five years of service.

Certification Examination in Ohio for Water & Sewage Personnel

The Advisory Board of Examiners for water and sewage treatment plant personnel of Ohio announces a certification examination to be held on April 22, 1955.

Examinations are to be held in the following cities: Cleveland, Columbus, Dayton, Massillon, and Toledo. Applications may be obtained from John E. Richards, Secretary, Ohio Dept. of Health, Columbus 15, Ohio. The deadline for filing applications is March 1st.

Uranium Mine Owned By Denver Water Board

According to a recent press report, a uranium strike on property belonging to the Denver Water Board brought quick action.

After hearing a report that some assays of the ore run up to $1,850 a ton, the board instructed water department Manager E. L. Mosley to negotiate for development of the strike with a royalty payment to the City of Denver.

Fluoridation by Automatic Control

Treatment can be accurately recorded and controlled by means of an electrical conductivity instrument

by KENNETH F. KNOWLTON

Mr. Knowlton is Superintendent-Chemist, Salem and Beverly Water Supply Board. The filtration plant at North Beverly, Mass., employs equipment for continuously monitoring the fluoride content of treated water. Problems of real and potential interferences have been investigated. Experience shows the automatic control of fluoride dosage to be fully practical.

A METHOD has been developed for continuously monitoring the fluoride content of the water treated in the North Beverly, Mass. filtration plant of the Salem and Beverly Water Supply Board. The author described the new development in a paper presented before the New England Water Works Assn. in 1953.

Additional data concerning the monitoring of fluoride has been accumulated and, more recently, the equipment has been adapted to actual control of the fluoride dose. The opening paragraphs of the author's earlier paper[1] describes the equipment and principles employed.

Electrical Conductivity Method

"Adaptation of the use of electrical conductivity is the basis of the method of fluoride recording which was used in this study. We all know when salt is added to water, an electric current will pass through the water more easily than it would without the salt. Any material which ionizes in water will show this same characteristic to some extent, and instruments have long since been developed to measure minute changes in the electrical conductivity of water. Procedures and definitions have been adopted for discussing these phenomena.

"Electrical conductivity is the reciprocal of electrical resistance, or one divided by resistance, expressed in ohms (1/ohms).

"The word 'mhos' (ohms backwards) is used to express units of conductivity. Specific conductivity is the conductivity at a given temperature of the material under test, as measured by two platinum plates, each one square centimeter in area and placed one centimeter apart. Since the conductivity is usually low (resistance high), we normally speak of micromhos, or units of a millionth of a mho.

"In the measurement of fluoride, arrangements are made to determine the specific conductivity of the water before fluoride addition and again after the addition of the chemicals. At Salem-Beverly the base conductivity of the water is in the order of 145 micromhos at 25°C.

"Since both sodium fluoride and sodium silico fluoride ionize in water, there is a change in the conductivity of the water when they are added. If measurements are delicate enough and all other factors, except the added fluoride, can be eliminated, we have a good method for adaptation to continuous analysis for the amount of the material which is added to the water."

Two Standard Cells Used

The heart of this system lies in the conductivity cells used to measure the electrical conductivity of the water before the fluoride is added and after the fluoride is added.

Fig. 1 is a photograph of a standard industrial type of carbon cell which is being used. These cells are made so that they may be inserted through the side of the pipeline and operate against 150 psi pressure, or they may be inserted directly into tanks or other vessels.

Fig. 2 is a schematic diagram illustrating the installation at the Salem-Beverly filtration plant. One conductivity cell precedes the fluoride addition, the other follows it at the greatest possible distance—to insure that adequate mixing will have taken place. Leads from these cells connect to the conductivity difference recorder and controller unit located in the laboratory building. Also included in this unit is a temperature recorder. The cabinet containing the conductivity recorder and temperature recorder, installed in the filter plant laboratory, is shown in Fig. 3.

Problems of Interference

There are several real and potential interferences which must be considered when using this method. Those which we have investigated are described below.

Temperature—Conductivity is very closely related to water temperature, and it is necessary that both conductivity cells operate at the same temperature or at a constant differential in temperature between the two cells so that the temperature effect may be balanced out.

The original installation included a temperature difference recorder which was operated for a sufficient period of time to show that there were very minor changes in temperature between the two cells, as was to be expected where they were installed in a single pipeline. After this information was obtained, the temperature instrument was changed to a straight temperature recorder giving the temperature of the water flowing through the plant.

Our instrument does not compensate automatically for base temperature changes in the water, and therefore it is necessary to use a correction curve for temperature when converting readings from electrical conductivity to fluoride.

Lime—Hydrated lime was being applied to the filter effluent for the correction of pH. This chemical is very slowly soluble in water and was fully expected to give erratic results on the fluoride recorder, since it would not be in complete solution as it passed the two electrodes.

Actual trial with the installation for a very short period of time showed this assumption to be correct. It was found necessary to transfer the application of lime to a point ahead of the filters, thereby assuring that the chemical was in complete solution at the time it reached the conductivity cells.

We have not experienced any operating difficulty in the altered appli-

cation of lime, although at higher doses we would expect some dissipation of color before the water was filtered.

Calgon—Calgon is used for corrosion control and is applied to the filter effluent ahead of the fluoride conductivity cells. The point of location of Calgon was transferred to a point more remote than previously from the upstream conductivity cell.

This chemical is fed as a solution and has very little, if any, effect on the performance of the fluoride recorder. On several occasions Calgon feed has been started, stopped, and changed in rate with barely perceptible changes on the chart record of fluoride concentration.

Chlorine—Chlorine is applied to the water at various points in the treatment process during different seasons of the year; the dosage varies as needed. A usual point of application is to the filter effluent. Chlorine has had very little, if any, effect upon the sensitivity or accuracy of the fluoride recorder.

Aluminum—Megregian and Maier[2] have described various substances which interfere with the colorimetric test for fluoride. Prominent among these is aluminum.

The interferences attributed to aluminum have been virtually duplicated in trials at our own laboratory. Since aluminum is considered to interfere because it forms a complex with the fluoride ion, it is conceivable that aluminum will affect the results shown by conductivity difference. This is a matter which should have more detailed study.

We are not certain as to whether or not it affects our results. It appears that if there is any effect from aluminum in the filtered water, it would not be greater (and probably would be less) than would be indicated in a colorimetric chemical test for fluoride.

Silica—As described by Babcock and Dobson[3], there is some question as to the interference effect of silica (contained in sodium silico fluoride or present in other forms in the water).

On several occasions during the past six months we have experimented with activated silica as an aid to coagulation. At times we have considered that there might be some effect from this added silica upon the action of the conductivity recorder. However, in most cases the silica treatment was used in order to reduce the residual alum in the filtered water, and it may have been the change in the aluminum concentration which was indicated on our chart.

Incomplete solution of fluoride salts—We believed that our original setup of equipment provided adequate detention capacity, in the dissolving chamber and in the pipeline, to insure complete solution of the fluoride salts before they reached the conductivity cell. There have been a few occasions, especially in cold weather, when there has been some doubt as to whether all of the sodium silico fluoride was in complete solution at the time the water passed the second conductivity cell.

Fig. 1—CONDUCTIVITY cell of standard industrial type is employed

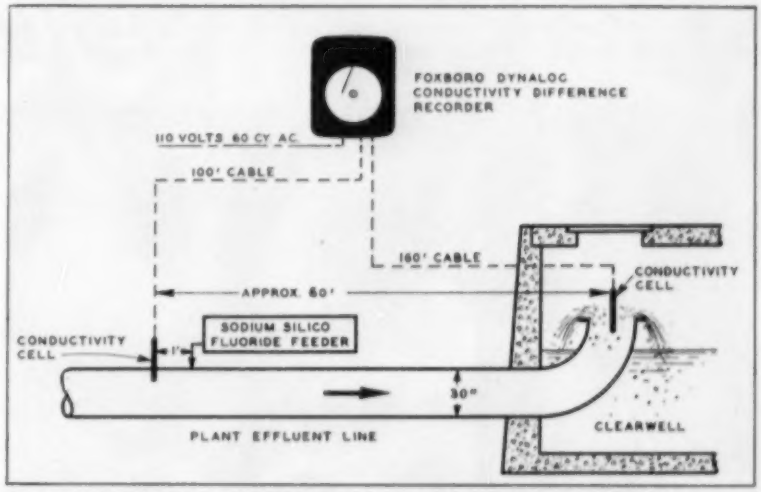


Fig. 2—SCHEMATIC diagram of the fluoride concentration recorder installation

General Operating Conditions

This method of recording the concentration of a chemical compound in water is extremely sensitive, and it was expected to show some drifting, or hunting, of the pen on the record chart. Quite extensive drifting did occur, and studies were made in an attempt to relate it to cycling of chemical feeders, filter rate controllers, or other phenomena throughout the treatment plant.

These studies were not successful in locating any specific reason for the fluctuation of the pen arm. We concluded that it might be impossible to get a smooth curve on the chart in filter plant operation where many chemicals were used and where the flow rate was subject to change from time to time.

The neighboring town of Danvers, Mass., was also using sodium silico fluoride to treat its water. The water is drawn from a pond and fluoride is added ahead of the high lift pumps. The only additional chemical treatment is chlorination, which is applied after pumping. The conductivity instrument was moved to Danvers for a test run. It was certain that the water would be of constant quality and the fluoride salt would be completely in solution at the time it passed the second conductivity cell.

In the Danvers test, hunting of the pen was considerably reduced and the zero location remained much more

constant. This indicated that where the water supply is constant, an excellent record could be obtained of the fluoride concentration. After the trial run at Danvers, the instrument was returned to the laboratory at the Salem-Beverly filtration plant. It has operated for several months, requiring little maintenance, and has provided a very useful record of the fluoride concentration in the water.

Improved Instrument Installed

A new instrument, including a pneumatic controller, was installed in the laboratory on February 24, 1954. The equipment is illustrated in Fig. 3. Before connecting the control mechanism, the new instrument was used for some time only as a recorder (similar to the original instrument). Hunting of the pen was still somewhat of a problem, but finally was solved by an adjustable instrument modification. This change did not reduce the sensitivity of the instrument, but did eliminate the wide swing of the pen arm. The instrument then provided neat, readable record of fluoride concentration in the treated water.

The necessary components were then assembled for a system to completely control fluoride application from the recorder-controller unit.

The system used in this arrangement consists of a pneumatic controller integrated with the recording mechanism. The pneumatic controller transmits an air signal (which is in proportion to the fluoride concentration) to a pneumatically controlled valve located in the discharge line from the solution pot of the fluoride feeder. Whenever the fluoride concentration in the water falls below the index point set on the controller, air pressure is built up. The air pressure opens the control valve and discharges more fluoride solution, thereby bringing the system back into balance. Conversely, if the fluoride concentration increases above that point set on the instrument, the valve automatically closes sufficiently to bring the system back to balance.

It is necessary, of course, that the fluoride feeder operate at a rate sufficient to meet the maximum fluoride demand at the maximum rate of water treatment. The controller will successfully prevent any over-dose of fluoride and will maintain the fluoride at the point set, so long as the feeder actually supplys the necessary chemical to the system. If anything should prevent the feeder from applying the chemical in amount sufficient to maintain the fluoride concentration at the desired rate, the recorder chart shows the actual fluoride concentration. When the concentration reaches a point below that desired, a light appears on the indicator panel. Both the light and an alarm system can function if desired.

Fig. 3—RECORDERS for fluoride concentration and temperature installed in laboratory

Relays Control Feeder Operation

A change was also made in the operation of the feeder. The fluoride feeder is now started and stopped by a system of level relays operated by electrodes in the solution chamber. By means of a solenoid valve, these electrodes will shut off the water supply to the solution chamber and also stop operation of the fluoride feeder when the water level in the solution pot reaches a point slightly below the overflow level of the chamber. When the level in the fluoride solution pot drops to a predetermined point, the second electrode causes the feeder and the water supply to start again.

The actual mechanics of pneumatic control have been discussed more thoroughly by Babcock[4, 5]. At our filtration plant, we have experienced no trouble with the pneumatic system, and the electronic system has required little maintenance with the exception of two or three burned out tubes in the early part of development. It has not been necessary to change a tube for at least one year.

The one source of difficulty in making automatic control function was the proper operation of the valve end of the pneumatic control system. In order to secure accurate control of the flow of the fluoride solution, a very small valve of the needle type was required. Considerable experimentation was necessary in order to keep this valve from plugging. We eventually found that mounting the valve on its side prevented the deposition of

any insoluble material under the valve seat. Since the valve has operated by automatic control, there has been no accumulation of material which has stopped the flow. We found that the plant operators had been using a broom to clean up small amounts of fluoride chemical around the loading hopper in the storage room, and occasionally a broom straw would break off and go through the feeder. The straws formerly had passed through the system without giving trouble, but they were unable to pass the small needle valve of the pneumatic control system. We no longer use the broom.

Charts Illustrate Operation

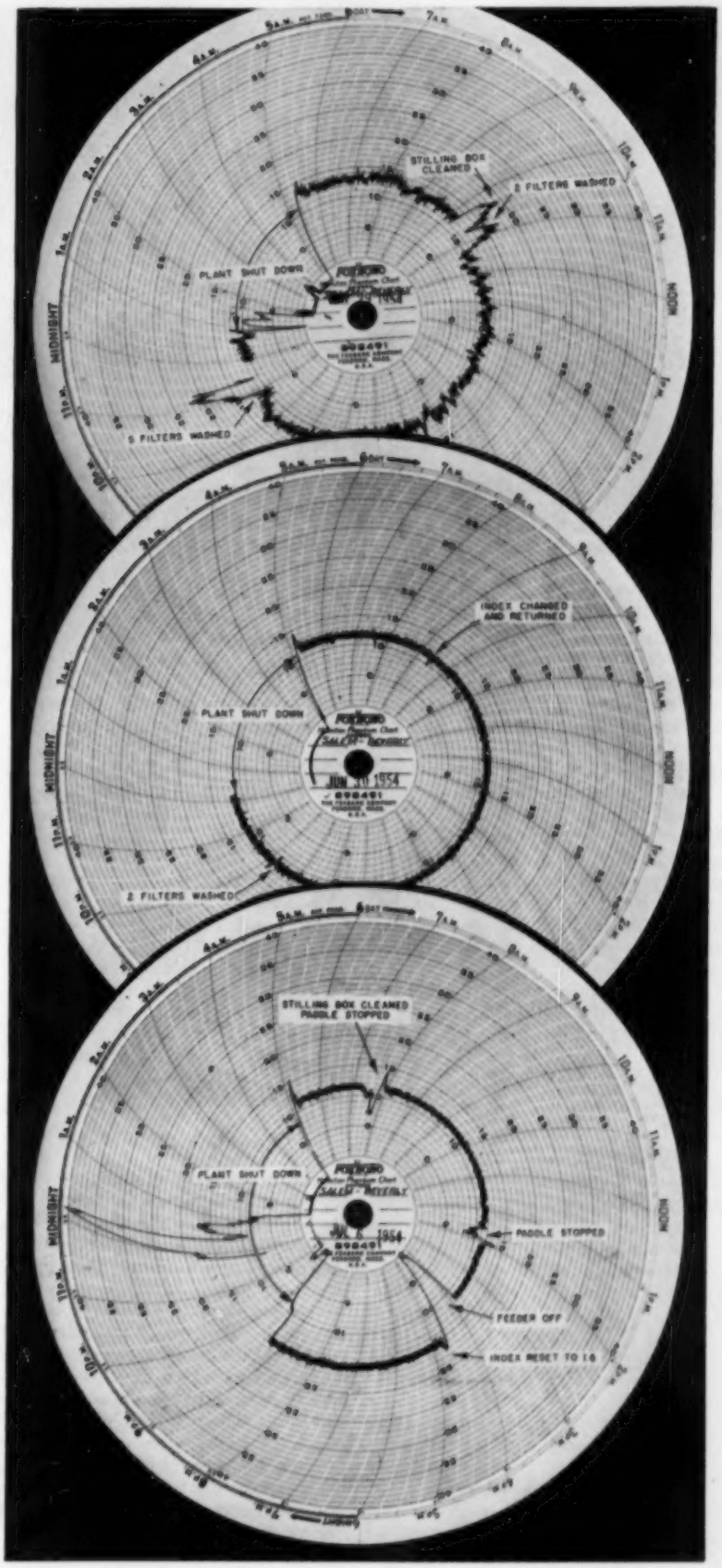
Three typical charts are reproduced to illustrate the operation of the pneumatic control instrument. Fig. 4 is a chart recorded after the drifting pen problem had been solved, indicating that there is much less "painting" of the charts than was evident in charts reproduced with the original paper[1]. At the time this chart was recorded, the instrument was not operating on automatic control, but was merely recording the fluoride which was being added to the water.

It will be seen that there are various ups and downs in the record; the variations are caused by the flow rate through the effluent line increasing and decreasing, without changes being made in the fluoride feed rate. At 10:15 A.M., the stilling box in the fluoride solution pot was cleaned, thus introducing a fairly heavy concentration of fluoride to the chamber for a short period of time.

Later, at 10:45, the flow rate through the effluent pipe was reduced while two filters were being washed. Again the fluoride concentration in the effluent was increased. After these two clean filters went into service, the flow rate was increased to some extent and the fluoride concentration was somewhat lower than previously.

Still later, at 11:00 P.M., filters were shut down for various periods of time while five of the filters were washed. During this severe reduction in rate, the fluoride concentration was increased to approximately two parts per million, for a period of only 10 minutes.

Fig. 5 is a normal chart recorded



TYPICAL CHARTS illustrate operation

Fig. 4—Record of fluoride concentration, automatic control not operating

Fig. 5—Normal chart record when automatic control is operating

Fig. 6—Chart record illustrating rapid recording and correcting of dosage

Fig. 7—The modern water filtration plant of the Salem and Beverly Water Supply Board

after the instrument was operating on automatic control. It will be seen that upon starting in the morning there was a very slight "overshooting," the instrument then steadied down the rate and held the dosage virtually constant throughout the day's run. At 9:25 A.M. the index pointer was moved down-scale for a short period of time to demonstrate its action to a visitor at the plant. At 9:45 P.M. two filters were out of service to be washed. There is a slight indication showing the distance by which the pen can leave the index setting before the instrument changes the fluoride dose, and returns the feed to the normal rate.

Fig. 6 is another chart recorded on a day when the instrument was controlling the fluoride dose. Again, there is evident a typical slight "overshooting" when the plant started in the morning. On this day, some trouble was experienced with the agitator in the fluoride solution box at 7:30 A.M. and again at 1:45 P.M. The chart record shows that such occurrences can be noted very quickly by the operator, and promptly corrected. At 3:45 P.M. fluoride application was stopped by setting the valve to its closed position, using the manual control switch at the recorder; the amount of fluoride being added dropped to zero. Upon restarting, the index point was set to a higher fluoride rate than previously, and the instrument immediately maintained the fluoride concentration at the new index setting.

It should be noted that all of these charts are recorded in terms of electrical conductivity difference. The actual fluoride content is determined from a curve of conductivity difference vs. fluoride for our water.

Table 1
Automatic Fluoride Application

	F-applied	Controller Setting
July 1	.66	0.65
2	.79	0.7
3	.65	0.7
4	.72	0.7
5	.67	0.7
6	.70	0.7/0.9
7	.93	0.9
8	.96	0.9
9	1.07	0.9
10	.99	0.9
11	.92	0.9
12	.74	0.9
13	.81	0.9
14	.78	0.9
15	.96	0.9
Average	0.82	0.82

Operating Experience

Our experience, extending over a period of eighteen months, with recording and controlling fluoride doses by means of an electrical conductivity instrument indicates that this equipment provides a satisfactory method for operating this process in water treatment. Mechanical troubles and electrical troubles have been at a minimum, and the instrument assures accurate control of fluoride dosage.

Table 1 shows the actual amount of sodium silico fluoride applied during the first 15 days of July. The chemical is reported in terms of fluoride ion and is compared to the doses called for by the setting of the controller.

It would be well to describe the difference in concept between this method and the usual method of gravimetric control of chemical feed. In gravimetric control, the chemical feed is actually set by the weight of chemical intended to be applied to a measured amount of water, and the feeder rate can be paced by the flow of water. In the conductivity method, the flow of chemical applied is actually proportioned to the concentration of chemical in the finished water. Regardless of the rate of water flow, if the concentration of chemical changes, the amount of applied chemical is automatically changed to balance conditions as they exist in the water. The automatic controller method does give a check on chemical feeder operation which is not available by the gravimetric method.

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2. Megregrian, Stephen and Maier, Franz J. "Modified Zirconium-Alizarin Reagent for Determination of Fluoride in Water." *Journal American Water Works Assoc.*, Vol 44, No. 3, March 1952.
3. Babcock, Russell H., and Dobson, John G. Discussion of Ref. No. 1. *Journal New England Water Works Assoc.*, Vol 68, No. 1, March 1954.
4. Babcock, Russell H. "Pneumatic Controls and Instrumentation for Water Plants." *Journal American Water Works Assoc.*, Vol 46, No. 2, February 1954.
5. Babcock, Russell H. "pH Measurement and Control in Water Treatment Plants." *Water and Sewage Works*, Vol 100, No. 7, July 1953.

W&SW

WATER WORKS PRACTICES

Distribution System—Design & Construction

The Nineteenth of a Series

by GEORGE E. SYMONS, Ph.D.
Dr. Symons is Consultant and Technical Editor, Larchmont, N. Y. In this series he discusses *Water Works Practices* in the form or short course lectures. These are designed to assist plant operators, students, and all who wish to review fundamentals in this field.

THE PROBLEMS of design and operation of a distribution system are many and varied. In this and the next lecture, an attempt will be made to classify and discuss most of these problems under a few main headings. In a general way these main headings are presented in the chronological order in which they might be encountered in a water works system.

Other writers in the field of waterworks practices may disagree both with the general headings and the classification of the operating problems under these several headings. For this presentation, however, the outline followed seems to be the simplest approach. At the end of the next lecture, an alphabetical cross-index is included to show under what categories, individual problems have been discussed. Thus, persons would choose another system of classification will be able to locate quickly, the individual problem discussions.

A . . . Sizing of Mains

1 . . NBFU Recommendations

a. The National Board of Fire Underwriters has developed a "Standard Schedule for Grading Cities and Towns of the U. S. with Reference to their Fire Defenses and Physical Conditions."

(1) The best known item in this schedule refers to adequacy of supply and supply works.

(2) The formula for the required fire flow under this section was presented and discussed in the lecture on "Design Criteria" and again in the lecture on "Distribution System Elements."

b. Adequacy involves sizes of mains (transmission, arterial, minor distributors and branches) as well as storage, pumping capacity, etc.

(1) The NBFU recommendations as to minimum pipe sizes for use in distribution systems are briefly:

. . . In high value districts—8 and 12-in.; 8-in. to be used only where it completes a good grid; 12-in. for longer lines not cross-connected.

. . . In residential districts—8-in.; 6-in. can be used only where it completes a good grid and never in blocks more than 600 ft long.

(2) The NBFU considers it poor practice to install mains smaller than 6-in. in water systems providing fire protection.

c. The NBFU Grading Schedule also includes items on pipe materials, pipe line grades, physical installations, and general arrangement of minor distributors.

2 . . Distribution System Layout

a. *Types of Systems*

(1) Circle or Belt—A complete loop of the arterial main around the area served with branches projecting inward.

(2) Tree—An arterial main runs through the area served (decreasing in size with distance); branches are taken off at right angles, with subbranches at right angles to the branches. (Fig. 1)

(3) Gridiron—All the ends of the various mains are connected in order to eliminate dead ends. (Fig. 1)

. . . This may become a belt system with a complete grid within the belt, or a single arterial main with the branches looped.

. . . Gridiron systems require more valves in order to isolate a section (four valves at each intersection, three at each tee). Therefore, some systems are designed as a compromise between a grid and a tree system.

. . . When a city is built on hills and valleys, it may be necessary to divide the distribution system into two or more pressure zones. These zones may be supplied by different distributing reservoirs or pressure regulators may be installed to maintain the pressure at approximately the same value in all zones.

b. Maps

(1) Few water works managers have the opportunity to lay out a complete distribution system and to construct it according to the proper balanced design.

(2) First step in planning a new system, extending an old system, or operating an existing system is to prepare a distribution system map, making whatever surveys are necessary.

(3) A wall map (400 ft to the inch) should show the entire pipe system. Sectional maps (24 x 36-in.; 50 or 100 ft to the inch) for the whole system should show the details of the system including valves, hydrants, etc. Intersections and congested areas should be enlarged.

. . . Both the wall map and the sectional maps should extend beyond the distribution system to include areas that are expected to develop in the next two or three decades.

(4) The wall map should show all streams, levels, grade changes, topographic features, streets (existing and proposed) population density in different areas, normal water consumption by areas, fire streams, and pressures at different points.

(5) A complete set of records of mains, valves, and hydrants should be keyed to the sectional maps.

c. Planning for Growth

(1) A long range program for distribution growth is a must for the alert manager. It should be kept up-to-date by regular revisions.

(2) Steps in a growth planning program include:

. . . A growth chart—Plot population, average daily pumpage, and maximum day pumpage against years.

. . . Estimate future population on

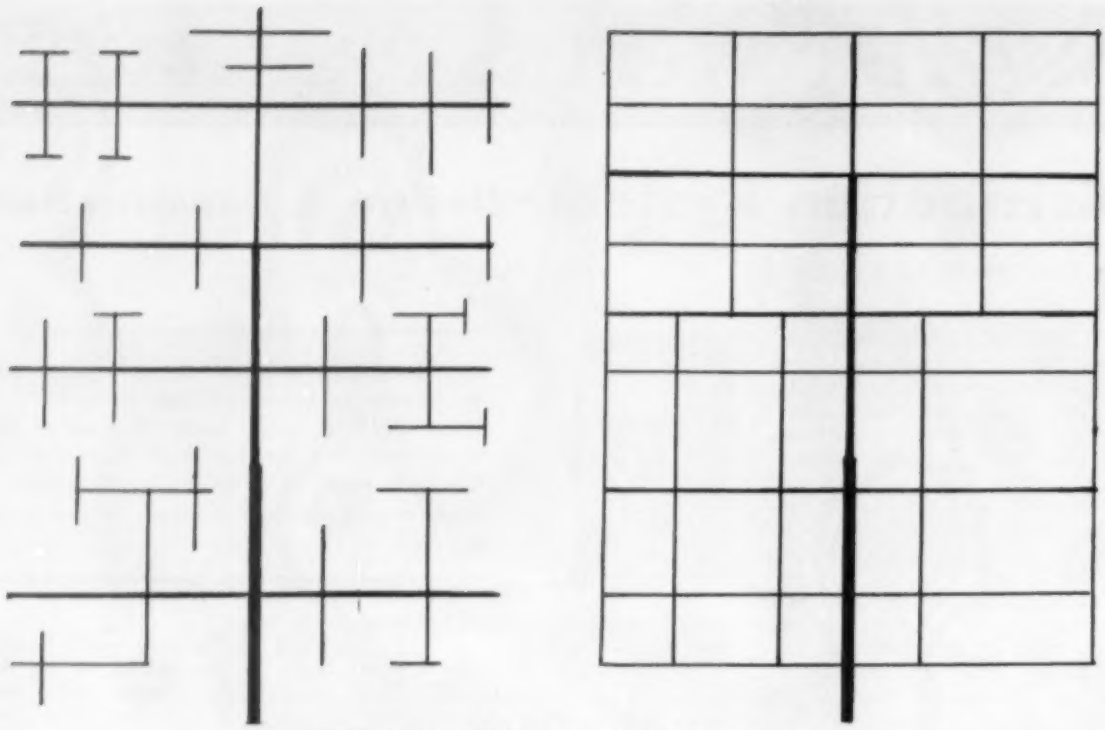


Fig. 1—TREE (left) and GRID (right) types of distribution systems

information obtained from Chamber of Commerce, school census, contractors, etc.

. . . Estimate water consumption growth based on increase in per capita consumption over past years. This value must be adjusted for use by industrial and commercial consumers.

. . . Extrapolate the maximum day consumption curve based on the expected population growth, per capita consumption and change in ratio of average to maximum daily consumption over the years.

(3) Future capacity must be able to supply the expected maximum daily demand.

(4) Per capita and maximum demand curves can be used to estimate demands for growth in individual sections.

3 . . Selecting Pipe Sizes

a. Sizes (capacity) of pipes in a distribution system are influenced by the total water demand for fire flow requirements on a maximum demand day. This capacity requirement usually is taken as the fire flow demand plus the average on the maximum day.

b. As indicated before, minimum pipe sizes are dictated largely by the recommendations of the National Bd. of Fire Underwriters

Actual pipe sizes selected depends on the determination of flow capacity and pressure required for each area served.

c. In practice, it is customary to use the next size pipe above the theoretical size indicated from determinations of the required flows in the pipe system.

4 . . Flow in Pipes

a. The carrying capacity of and pressure in pipe depends on the velocity of flow and the loss of head due to friction forces in the pipe.

(1) Friction factors depend on loss of head due to roughness of the pipe and Reynolds Number, which in turn depends, in part, on velocity in the pipe and the pipe diameter.

(2) Pipe flow formulas include a coefficient of roughness, "C," which varies with pipe size and velocity of flow.

b. The Hazen-Williams Formula is most commonly used:

$$V = CR^{0.63}\, s^{0.54}\, 0.001^{0.54}$$

or

$$V = 1.318\ CR^{0.63}\, s^{0.54}$$

where

V = Velocity in ft per sec
C = Coefficient of roughness
R = hydraulic radius of pipe in ft.
s = hydraulic gradient in ft. per 1000 ft.

(1) This is the same formula presented in the lecture on "Loss of Head" It is repeated here because of its frequent use in distribution system studies.

(2) This formula is difficult to use in ordinary work but a special slide rule for Hazen-Williams calculations may be obtained gratis from the Cast Iron Pipe Research Ass., Chicago, Ill. or from Grinnell Co., Providence, R. I.

(3) In place of the slide rule calculation, a nomogram may be used advantageously. (Fig. 2) It was developed by D. R. Kieth and published in the Reference & Data Number of *Water & Sewage Works,* page R-177, April 1952. (A special nomogram for concrete pipe, the Scobey Formula, also from *Water & Sewage Works,* appeared in the lecture on "Loss of Head")

(4) From the velocity of flow, loss of head for the length of pipe, and required flow in gpm, it is possible to determine the size of pipe required.

(5) The value of "C" for different pipe materials is generally given as follows:

Pipe Material	C Value
Concrete (*best workmanship*)	150
Cement-lined Cast Iron	140
Cast iron-new, extremely smooth	140
Asbestos-cement	140
Cast iron, new, very smooth	130
Wood stave—smooth	120
Vitrified pipe	110
Cast iron—15 to 20 yr. old	100
Concrete (poor workmanship)	90

5 . . Balancing Flows

a. In computing flows in the distribution system it is necessary to calculate quantity take-offs from the arterial mains to the various branches or areas under study and to determine the hydraulic grade line of the system,

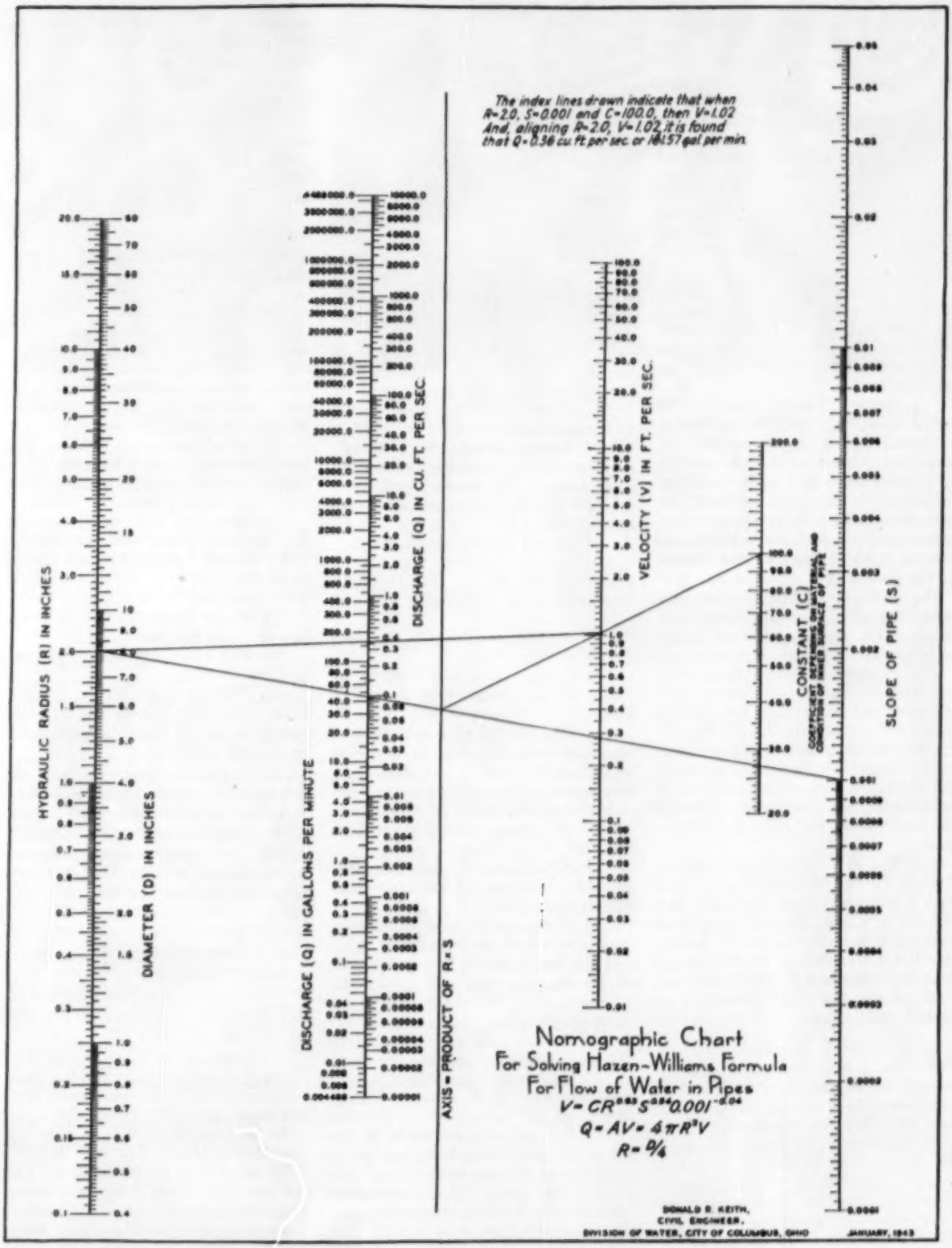

The index lines drawn indicate that when R=2.0, S=0.001 and C=100.0, then V=1.02
And, aligning R=2.0, V=1.02, it is found that Q=0.36 cu ft per sec or 161.57 gal per min.
HYDRAULIC RADIUS (R) IN INCHES
DIAMETER (D) IN INCHES
DISCHARGE (Q) IN GALLONS PER MINUTE
DISCHARGE (Q) IN CU. FT. PER SEC.
AXIS = PRODUCT OF R x S
VELOCITY (V) IN FT. PER SEC.
CONSTANT (C)
COEFFICIENT DEPENDING ON MATERIAL AND CONDITION OF INNER SURFACE OF PIPE
SLOPE OF PIPE (S)
Nomographic Chart
For Solving Hazen-Williams Formula
For Flow of Water in Pipes
$V = CR^{0.63}S^{0.54}0.001^{-0.04}$
$Q = AV = 4\pi R^2 V$
$R = D/4$
DONALD R. KEITH,
CIVIL ENGINEER,
DIVISION OF WATER, CITY OF COLUMBUS, OHIO
JANUARY, 1943

Fig. 2—CHART for solving Hazen-Williams flow formula problems

DIRECTIONS FOR USING CHART: Place straightedge on "D" scale at pipe diameter in inches and on "S" scale at loss of head per foot of pipe. Determine point on "Axis" line where straightedge crosses. Then place straightedge on this point on the Axis line at constant "C" for the pipe in question. Determine point where straightedge then crosses velocity "V" scale. Next place straightedge on this point on "V" scale and on diameter of pipe in inches on "D" scale. Read discharge "Q" in cfs or gpm where straightedge crosses "Q" line.

that is, a chart of the pressures and flows available along the lines and at all points in the system. This operation is termed analyzing the distribution system.

b. There are six methods of solving problems and analyzing the distribution system.

(1) Uncontrolled Trial and Error —a slow, difficult method using simple arithmetical relations.

(2) Equivalent Pipe Method—a method of omitting and combining pipes to form series and parallel compound pipes.

(3) Graphical Method—Often called the Freeman Method because it was described by J. R. Freeman; variations are also described by A. K. Palsgrove and Rensselaer Polytechnical Institute.

(4) Hardy Cross Method—As stated by Babbitt and Doland this is a method "based on the fact that the loss of head from one point to another in a distribution system is the same, regardless of the path followed. To find the correct flow in a network of pipes, assume a flow and calculate the loss of head throughout the system by the Hazen-Williams pipe-flow formula. If the head loss between two points are not the same through different paths, the assumed flow is corrected and the calculation repeated.

(5) Electric Network Analyzer—An electrical analogy circuit employing electrical resistances for friction losses will provide the answer quickly for any distribution network problem.

(6) Hydraulic Model—A model of the system is used, but problems of scale factors are introduced and model construction is exacting and expensive.

(7) The first four methods require trial and error to some degree. Both the Equivalent Pipe Method[1] and the Hardy Cross Method[2] have been adequately described in *Water & Sewage Works*. Details of these methods are also described in handbooks and in the texts listed as references at the end of this lecture.

6 . . Extension Policy

a. The term, "extension policy," usually applies to water lines outside the municipal corporate limits or into new real estate developments.

b. Extension policies usually apply to matters of financing extension rather than sizes of mains. Sizing is done according to principles outlined heretofore but financing is an important problem of management.

[1] *Water & Sewage Works*, (R&D), page R-81, April 1948; pages R-39 and R-42, July 1941.

[2] *Water & Sewage Works*, March 1943.

B . . . Main Installation

1 . . Trenching

a. Water mains are laid underground, usually below the frost line and deep enough to give protection against traffic loads and to avoid interferences by other utility structures.

(1) Depths up to 9 ft are used in the coldest states and as little as 2.5 ft in the south and on the West Coast.

(2) One notable exception to underground lines is the exposed supply line from Homestead to Key West, Fla. Other exceptions include lines laid alongside of bridges across marsh lands, bodies of water, railroads and deep valleys.

b. Mains are laid in trenches cut through the earth, with the excavation being made with machines or by hand. Earth trenching utilizes one technique, rock trenching another.

c. Trenches should be wide enough to allow ease of working around the pipe. Usually the trench should be 1 ft wider than the pipe diameter (minimum width, 2 ft).

2 . . Pipe Handling and Laying

a. Handling includes removal of pipe from freight car, transportation to storage or to installation site and placing in the trench.

(1) Small pipes are readily handled by derrick on a truck.

(2) Larger pipes are lowered by ropes at each end with a rolling hitch.

(3) Pipe should be sounded when removed from the freight car, and again before lowering into the trench, to ascertain if any defects are present.

b. Basic principles of installation have been recommended by various writers.

(1) Never install pipe in filled ground unless the fill has been thoroughly compacted.

(2) Never install pipe directly on rock; use a 6-in. earth cushion.

(3) Deposit earth, free from rock, in layers and tamp well under the pipe, and bring bed under pipe to desired grade.

(4) Excavate for pipe bells before the pipe is lowered into the trench.

(5) Before the pipe length is lowered into the trench, brush it free of loose dirt.

(6) Before joints are made, scrape all earth and foreign matter which might enter the pipe when in use.

(7) Use thrust blocks wherever pipe size or direction changes.

3 . . Backfilling

a. Never allow cinders or other corrosive materials to contact unprotected iron or steel pipe.

b. Deposit dirt, free from rock, and tamp well up to the spring line of the pipe before backfilling.

c. Backfilling may be done by hand or machine. The earth cover immediately above the pipe should be free of large stone or rock.

d. Hand tamping or machine tamping may be used.

e. Consolidation of backfill is readily accomplished by puddling.

(1) A piece of pipe is attached to the end of a hose and pushed into the loose soil until it touches the main.

(2) Water is allowed to run until it appears at the surface. The soil settles to approximately its original compacted condition.

4 . . Valves and Hydrants

a. Valves are required to isolate small areas, as discussed previously.

(1) The ideal arrangement is to have a valve on each line which intersects with another; this means four valves at crosses, 3 at tees.

(2) A less expensive valving system, commonly used, is to employ two valves on adjacent right angle legs of every intersecting cross.

(3) Set valves on concrete base and provide valve box or manhole to allow quick shutoff. Large valves are placed in vaults.

b. Hydrants

(1) Place hydrants on a 6-in. branch from the main.

(2) Use a concrete base to prevent settling.

(3) Provide a gravel or crushed stone "dry-well" around base to allow escape of water through drain holes to prevent freezing.

(4) Valves on hydrant lines are protection in case hydrants are broken by car or truck accident—also for use when repairing or removing hydrants.

(5) Spacing of hydrants is dictated by the Board of Fire Underwriter's schedules discussed before.

5 . . Testing

a. Leakage allowable in new mains is usually specified.

(1) Common specifications are 60 to 250 gal per inch diameter per mile of pipe per 24 hours.

(2) Leakage tests are made after 30 days if sulfur joint caulking compounds are used; for lead joints tests are made soon after laying.

b. Sections of 1000 ft of pipe line are usually tested. The pipe is filled with water (all air is expelled) and the pressure brought up to working pressure or at some specified pressure. Pressure is maintained by hand pump and the amount of leakage determined by a water meter.

6 . . Cross Connections

a. A cross connection is any physical connection, direct or indirect that may possibly permit flow of water

PIPE laying operations

from a non-potable to a potable supply.

b. An inter-connection is a connection between two potable supplies established for mutual benefit in time of emergency.

c. Cross connections of any kind are to be avoided. Where impossible to prevent, as with connections to industrial supplies, double check valves or other aproved backflow preventers must be used.

7 . . MOVING MAINS

a. Water mains may have to be raised or lowered owing to regrading of streets or highways.

(1) Raising or lowering can be done by blocks and jacks without removing the line from service if the pipes are moved a little at a time.

(2) Lead or mechanical joints permit such movement because of flexibility. Sulfur compound and cement joints are less flexible but will allow some movement.

b. Mains must sometimes be relocated because of highway relocations. This involves laying an entirely new line and removing the old one. It also involves a problem in financing, since payment for this removal may not be forthcoming from the highway department which required the relocation.

C . . . Disinfection

a. All water mains must be disinfected before being put into use.

b. The A. W. W A. tentative "Specifications for Disinfecting Water Main" (AWWA C601-53T) sets forth the best accepted procedures.

(1) Laying pipe, trench water, jointing material, and flushing in relation to disinfection are discussed.

(2) Chlorination is required using either chlorine gas-water mixture or hypochlorites.

(3) Point of application is ahead of any pipeline extension or ahead of any main.

(4) Rate of application must be high enough to produce 10 ppm residual after 24 hr standing; probably need 25 to 50 ppm dosage added to water as it enters pipe line.

. . . Some operators prefer dosage of a continuous flow through the new main for 24 hr or more.

. . . Others dose water until pipe line is full and discharge is allowed until it contains 25 ppm or more of chlorine at which time flow is stopped and the pipe allowed to stand for 24 hours.

(5) After 24 hours, if the chlorine residual is high enough the line is flushed and bacterial tests run to determine if water meets quality requirement.

. . . If water tested is not up to standard, the disinfection procedure is repeated.

c. The A.W.W.A. specifications also include a procedure to follow when repairing or cutting into existing lines.

d. An excellent reference on a procedure for main disinfection was published as Keep Sheet No. 12 of B-I-F Industries, Inc. It was reprinted in *Water & Sewage Works*, Ref. & Data Ed. p. R-170-71, May 1954.

D . . . References

Material for this lecture was based on current technical literature and several reference texts which included:

Babbit and Doland "Water Supply Engineering" (McGraw-Hill)
Fair and Geyer, "Water Supply and Waste Water Disposal" (John Wiley & Sons)
Hardenbergh, "Water Supply and Purification" (Int. Textbook Co.)
King, "Handbook of Hydraulics" (McGraw-Hill)
Steel, "Water Supply and Sewerage" (McGraw-Hill)

NEXT LECTURE: Distribution System —Part 3—Operation

W&SW

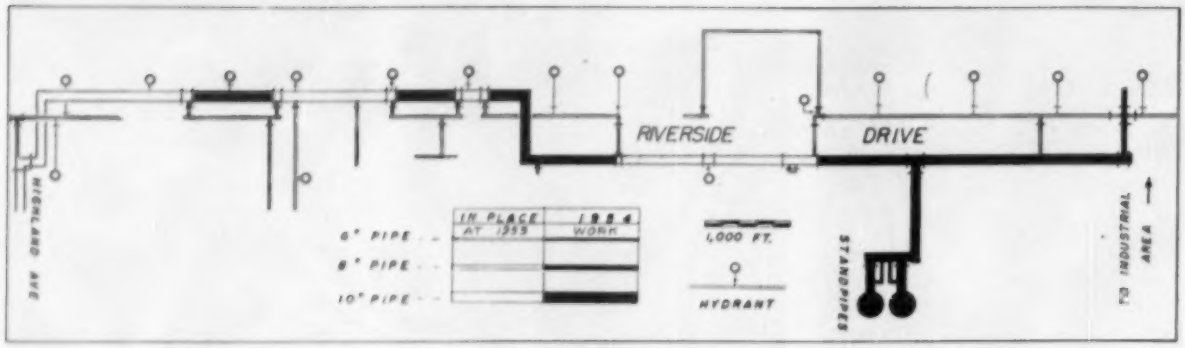
Harry Lundquist Honored by South Dakota W&SW Group

The South Dakota Water and Sewage Works Conference has recognized the retirement of Harry Lundquist of Minneapolis, after 27 years as the Neptune Meter Co. representative in Minnesota, North and South Dakota, with a special resolution of appreciation. The resolution, adopted at a meeting of the Conference in Mitchell, S. D., follows:

"Whereas, Harry Lundquist representing the Neptune Meter Company in this area for 27 years has been an esteemed member of the South Dakota Water & Sewage Works Conference; and has participated actively in the official and non-official activities of the Conference,

"Therefore, Be It Resolved, that the South Dakota Water & Sewage Works Conference express to Harry Lundquist its very sincere appreciation for his service to that organization and conveys to him best wishes for an enjoyable retirement and an invitation to return during future meetings."

Mr. Lundquist, who was in charge of the water department in Moline, Ill., for nine years, worked for the Thomson Meter Co., from 1922 to 1925 before joining Neptune Meter Co.



MANIFOLD piping and valving arrangements for increasing flexibility of standpipe service and maintenance

Tale of Two Standpipes

by S. S. ANTHONY, Supt.
Augusta Water District
Augusta, Maine

DURING the period prior to World War I, people began to move out from Augusta into the country and extensions were made in many directions from the built up sections. One of these extensions was a 6″ main out Riverside Drive on the Waterville Road.

In 1916 about a mile of 6″ pipe was installed to extend this 6″ line. I presume 6″ pipe was used because that is what they had to start from, and in those days no one ever heard of the idea of extending a main with larger pipe than was already there.

In 1920 a half mile of 6″ pipe was added; 1922 three quarters of a mile; 1923 another half mile; 1925 more than a mile. So we had five miles of 6″ main strung out along Riverside Drive and the Waterville Road, with 22 hydrants and upwards of 200 customers, almost altogether residential and in no case was there congestion. Houses were well separated and service was adequate for domestic use.

Fire protection was a different matter, however. The last hydrant, on the end of the line, wide open, would not move the needle of a pressure gauge. Each hydrant has a pumper nozzle, however, and during the very infrequent fires in this area, the fire department could pump a fair stream of water, but you can imagine the sorry plight of copper hot water tanks in the homes when the pumper was pulling twenty inches of vacuum on this 6″ main.

Riverside Drive was a popular place to build, and still is.

Relocation Work

In 1950 the State Highway Commission rebuilt four miles of the Waterville Road, the same four miles where we had all this six inch pipe. Fortunately, the layout of the road as built in 1918 was such that few changes were necessary, a few curves being flattened to some extent. The grade was largely adequate for present day standards, also, cuts of a few feet and fills of somewhat greater extent being required. The old 6″ pipe was installed uniformly in the westerly shoulder, or just off the paving line, which consisted merely of surface treated gravel, with little attempt to subgrade drainage. All hydrants were also on the West side of the road, spaced about 1,000 feet apart. Service connections were about equal on each side. The services which crossed the road were driven through under the road where possible. Where ledge was encountered, we usually dug half the road, blasted, refilled and then did the other half.

For the 1950 construction, which was originally planned in 1946, we were furnished a complete set of plans in advance by the State Highway Commission and were able to design necessary changes and purchase required materials, most of which we had on hand when the final go-ahead was given.

It was fully realized that service in this area was below standard, and where changes in alignment and grade were required by the new construction we installed 10″ cement lined cast iron pipe, connecting it to the 6″ pipe which was to remain in place, with plenty of tees and gate valves, so that when further improvements would be required we could accomplish this with little or no interruption of existing service.

We adopted the policy of replacing all of the older service connections with copper tubing. All hydrants were relocated to a point twenty feet from the edge of paving, placing them beyond the ditch line and back of any common windrow of snow which might be thrown up by plows.

If the existing six inch main was to be covered more than eight feet by the new construction, it was replaced. It was also replaced if it would be left with less than four and a half feet of cover. As stated previously, all main replacement was made with 10″ cement lined cast iron pipe, placed in the shoulder, twenty feet from center line or eight feet from edge of paving, making it possible to provide future service connections without disturbing the bituminous concrete paving placed on the whole job.

When this work was done we finally wound up with all

ED NOTE: This paper, presented before the Maine Water Utilities Assn., is being printed by permission.

relocated, with the remainder being left as they were, since they were already farther from the roadway than the standard distance, and a composite of 6" unlined pipe and 10" cement lined pipe in alternate sections in the southerly half of the project as follows:

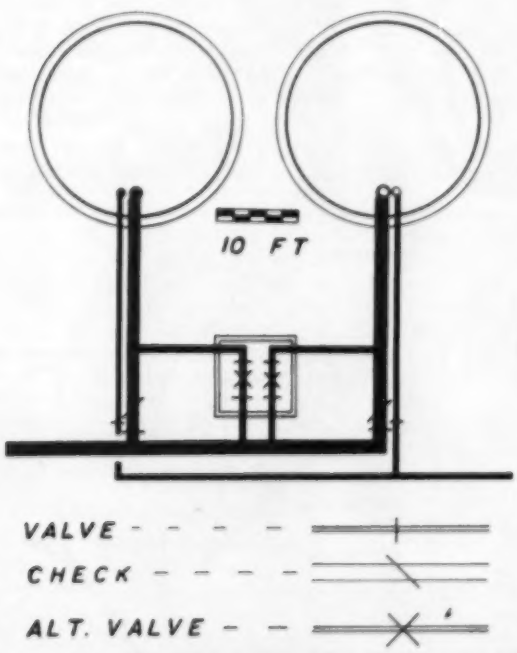
2,000 feet of 10" pipe
1,050 feet of 6" pipe
1,340 feet of 10" pipe
800 feet of 6" pipe
250 feet of 10" pipe
1,550 feet of 6" pipe
2,000 feet of 10" pipe
Total 8,990 feet

Then Comes 1954

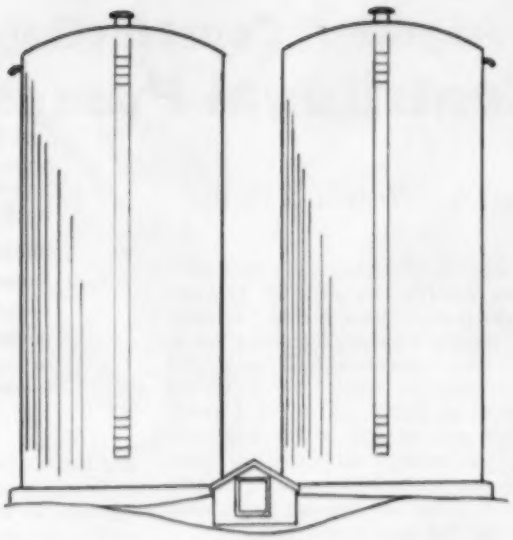
Then, early in 1954, an industrial development was started nearly a mile beyond our last bit of 10" pipe, with the first prospect a substantial user of water and others requiring fire protection by means of sprinkler service and hydrants.

After much discussion in committees, and here and there, the District Trustees authorized a general strengthening of the system in this area. This involved replacement of the 6" sections with 10" pipe and adding 3,500 feet more of 10" cement lined pipe to the start of the industrial development. In addition, storage tanks are being installed well up the line. A convenient knoll was located about 100 feet above the general level of the Waterville Road, and about three quarters of the way up the line. Its crest is at a height which permits a fifty foot high standpipe to be located thereon. The overflow level is enough below the water level in our main distribution reservoirs so that, with all the 10" main, use from storage during the day should be replaced during the night.

It is probable that, some time in the future, demand in the area will increase to such an extent that night recovery by gravity cannot be depended upon. At that time booster pumps will be installed.



IMPROVEMENTS, including twin-standpipes on Riverside Drive



TWIN-STANDPIPES and control house, seen from Riverside Drive

Twin Standpipes Have Advantages

Having in mind the difficulties in maintaining adequate and dependable service during painting operations at two other locations in Augusta, supplied by standpipes and booster pumps, I recommended to the Trustees that we install two tanks, side by side, separately valved and controlled, so that one could be taken out of service for maintenance with little effect on service. The tank companies quoted a surprisingly small differential between two tanks at 150,000 gallons each and a single unit of 300,000 gallon capacity. Foundation costs would not be doubled, nor would piping connections. It is believed that $4,000 will cover the entire extra cost of this plan and the fixed charges on this amount are only about $200 per year. Such annual cost seems justified when considering the inconvenience and poor service occasioned by trying to clean, paint and restore to service a single tank, when perhaps we might run into a spell of poor painting weather and extend the job and deficient service for many days. Booster pumping without the flexibility of tank service also is unsatisfactory. Pumps have to be throttled to avoid excess pressures in mains and services, or water wasting relief valves must be installed. Then too, with booster pumps alone some of the customers on high elevations suddenly find themselves waterless while well lathered up in the shower. Automatic washing machines are also amongst other things to consider.

Instead of running the branch main to the standpipe directly, into the center of the group we have installed what might be termed a piping manifold. A tee is also being installed for still further storage to the South on the same lot, if and when needed. The diagrammatic sketch of the installation, now well advanced, shows how the piping and valving arrangement for greater flexibility was accomplished.

This is our first experiment with twin tanks. If it works out as anticipated, we will have others. At present two or three others areas in Augusta are slated for combinations of auxiliary storage and booster pumping to improve service, while also selling more water to pay the costs.

W&SW

Designing, Constructing and Maintaining Centrifugal Pumps

Part 4—Wearing Rings

by ROY CARTER and IGOR J. KARASSIK

Mr. Carter is manager of the Volute Pump Section, and Mr. Karassik is manager of the Multistage Pump Section, Centrifugal Pump Division, Worthington Corp., Harrison, N. J. This new series has been prepared by Messrs. Carter and Karassik to review characteristics of centrifugal pumps for water and sewage service.

JUDGED BY many industrial service records, water and sewage works pumps "have it easy." Casings and impellers usually last many years; it is very common to find pumps that have been in water works service twenty to thirty years. As a result water and sewage works engineers are particularly interested in these few parts which do require maintenance. These are wearing rings, shaft sleeves and bearings.

The basic reason for employing wearing rings in a centrifugal pump is to provide an easily and cheaply renewable leakage joint between the impeller and the casing. A leakage joint between the casing and impeller without a renewable part is illustrated in Fig. 1.

To restore the original clearance, when wear occurrs, the operator must either (1) build up the worn surfaces by welding, metal spraying or other means and then true up the part or (2) buy new parts. With small pumps the latter method is not very costly, especially if the stationary casing element is a simple suction cover. With small pumps the cost of a renewable stationary ring would in some cases differ very little from a whole suction cover. This is not true in the case of larger pumps, however, or where the stationary element of the leakage joint is part of a complicated casting.

Where the first cost of a pump is of prime importance, the designer serves the interest of the original purchaser and the operator by providing means so the stationary parts (and often the impeller as well) can be remachined, and a renewable casing ring or both renewable casing and impeller rings, can then be installed. An example of such a design is shown in Figs. 1, 2, and 3.

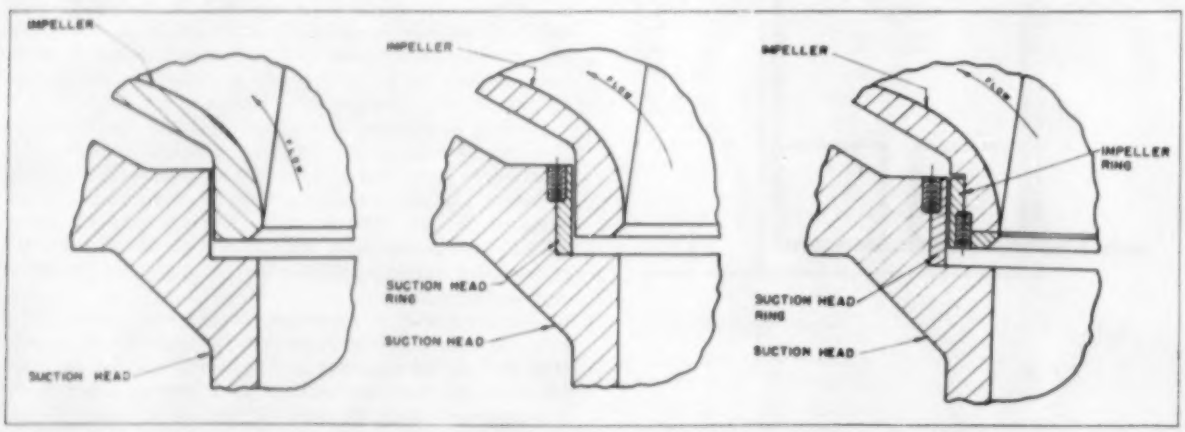
Wearing Rings Described

As explained in Part 1 of this series, the nomenclature for the casing or stationary part forming the leakage joint surface, is as follows: *casing ring*, if mounted in the casing; *suction cover* or *suction head ring* if mounted in a suction cover or head; or *stuffing box cover* or *head ring* if mounted in the stuffing box cover or head. Some like to identify the part further by adding the word "wearing" in front of ring such as "casing wearing ring." A renewable part for the wearing surface on an impeller is called the impeller ring. Pumps with both stationary and rotating rings are said to have "double ring" construction.

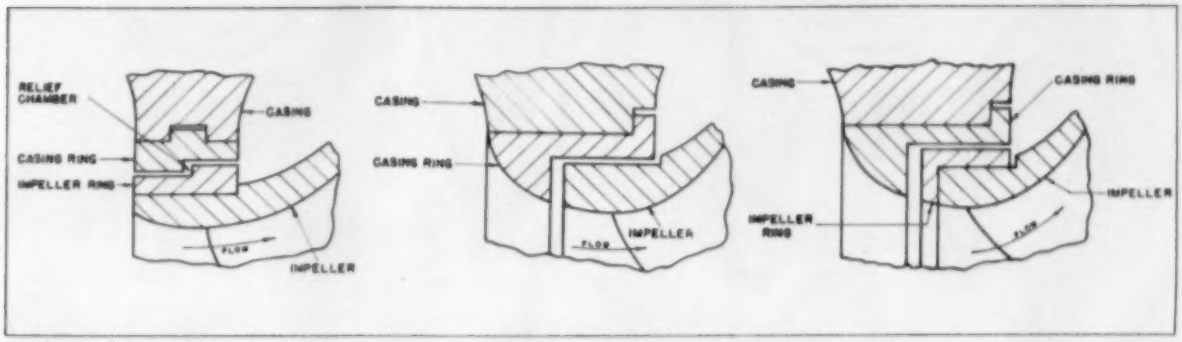
Various types of wearing rings designs have been developed and for specific services the most desirable type will depend on the liquid being handled, the pressure differential across the leakage joint, the rubbing speed and the particular pump design. In general, designers of centrifugal pumps apply a ring construction which they have found to be suitable for the services on which the pump is to be used.

Wearing Ring Construction

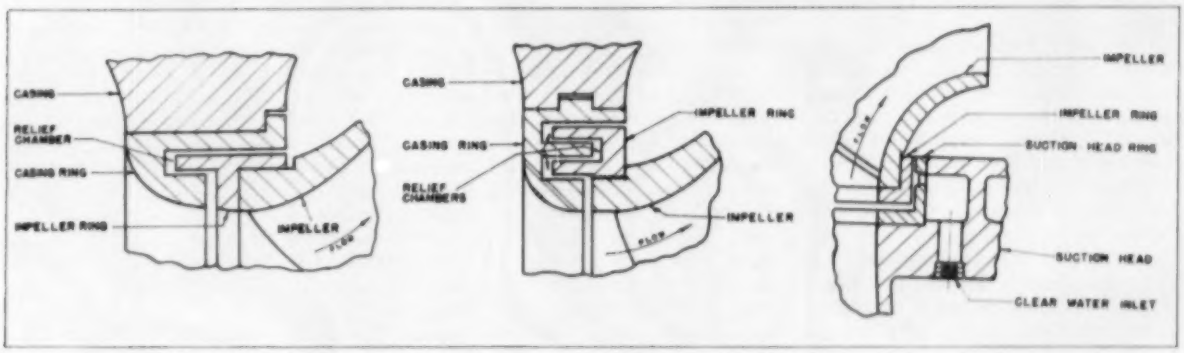
The most commonly used types of ring construction are the flat and "L" types. The former is illustrated in Figs. 2 and 3 and the leakage joint is a straight annular clearance. With the "L" type ring illustrated in Fig. 5 the axial clearance between the impeller and the casing ring is large; thus, the velocity of the liquid flowing into the stream of liquid into the suction eye of the impeller is low. The "L" type casing rings shown in Figs. 5 and 6 have the additional function of guiding the liquid into the impeller eye and are called "nozzle ring" type. Impeller rings of the "L" type as shown in Fig. 6 also furnish protection for the face of the wearing ring



CENTRIFUGAL PUMP SECTIONS—Illustrating the construction of leakage joints between pump impeller and casing. Fig. 1—Flat leakage joint, no rings. Fig. 2—Single flat casing ring. Fig. 3—Double flat casing ring.



LEAKAGE JOINT CONSTRUCTION. Fig. 4—Step type double rings. Fig. 5—Casing ring, "L" nozzle type. Fig. 6—Double "L" type rings.



LABYRINTH RINGS. Fig. 7—Single intermeshing type, nozzle casing ring. Fig. 8—Double intermeshing type. Fig. 9—Water-flushed wearing ring.

hub of the impeller (there is a face-to-face joint provided between the "casing" section and the "casing ring" section).

Among the other designs of wearing rings in use, the labyrinth type shown in Figs. 7 and 8 is favored by some. Such a ring design has two or more annular leakage joints connected by relief chambers. In leakage joints involving a single unbroken path the flow is a function of the area, the length and the pressure differential. If the path is broken by relief chambers, such as those illustrated in Figs. 4, 7 and 8, the velocity energy in the jet is dissipated in each relief chamber increasing the resistance. As a result, with several relief chambers and several leakage joints, as in Fig. 8, for the same actual flow through the joint are (and hence the clearance between the rings) can be greater than for an unbroken shorter leakage joint.

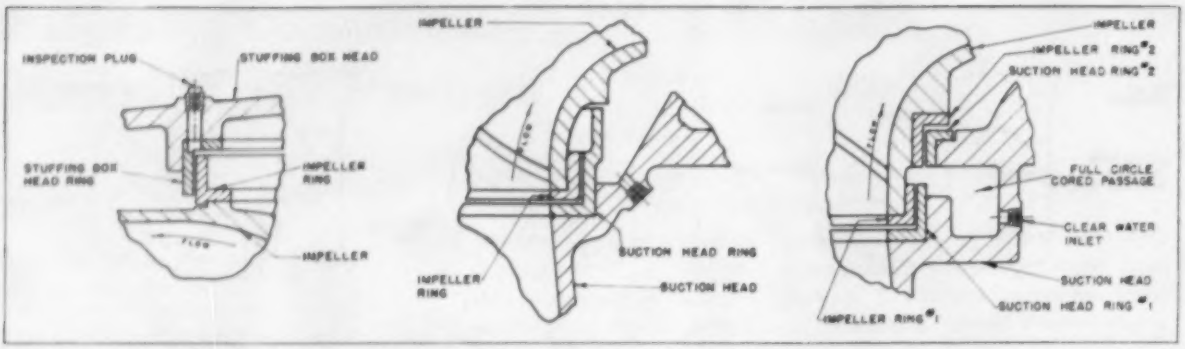
Examples of Wearing Rings

The single labyrinth ring with only one relief chamber, as shown in Fig. 7, is often called an intermeshing ring. The step ring type, illustrated in Fig. 4, utilizes two flat ring elements of slightly different diameters on the total width of the leakage joint, and has a relief chamber between the two elements. There are also ring designs using some other form of relief chambers. One in common use in small pumps, for example, has the flat joint similar to that in Fig. 1; but this design with one surface broken by a number of grooves acting as relief chambers to dissipate the velocity head of the jet, and hence to increase the resistance through the joint with resulting decrease in leakage.

For raw water pumps in water works service, and for larger pumps on sewage service (where sand and grit is contained in the liquid being pumped), there has been considerable interest in water-flushed rings. One design of these rings is illustrated in Fig. 9. In this design a separate source of clear water, under a pressure greater than that on the discharge side of the rings, is piped to the inlet indicated.

It is distributed by the cored passage, the holes through the stationary ring, and the groove to the leakage joint. In this ring, the basic thought is that the clear water would always fill the leakage joint with some flow, both to the suction and discharge sides, thus preventing any sand or grit getting into the clearance space. The results, in general, have not been entirely satisfactory. In a discussion on this type of ring, one designer claims such a design will exclude sand if made to provide a flow of 1 per cent of the pump capacity per ring. To provide such a large amount of clear water would naturally be expensive, and it would often be as economical not to use flushing but to allow wear to increase the clearance between the rings excessively before replacement. The trend at present, with small and medium size pumps handling sandy or gritty water is to use wear-resisting metals such as chrome steels for the rings, and to replace the rings as wear increases the clearance excessively.

In large pumps (roughly 36-in. or larger discharge size), particularly of the vertical end-suction single-stage volute type, the large physical size of the pump involved allows refinements in many details which could not be included in smaller pumps. In some designs of large pumps, one refinement as shown in Fig. 10 is the inclusion of inspection ports allowing measurement of the ring clearance. Not only is this feature helpful in the original erection to check on the proper centering of the impeller, but it permits making checks on the wear



LARGE PUMP DESIGNS. Fig. 10—Inspection port to check clearance. Fig. 11—Dam-type ring construction. Fig. 12—Double rings with flushing space.

of the rings without dismantling the pump.

The lower rings of such vertical pumps handling liquids containing sand and grit are very liable to wear, especially if the pump is not run continuously. During periods of shut down, grit and sand in the liquid in the pump will naturally settle out. As the region at which the rings are installed is the lowest point on the discharge side, this sand and grit will accumulate mostly around the rings. When the pump is again operated, accumulated sand and grit is at once washed into the joint—with resulting increased wear for that period. To prevent this wear on medium and large sizes of these pumps, a dam-type ring, as illustrated in Fig. 11, is often used. Periodically the pocket on the discharge side of the dam can be flushed out.

One trouble with the water-flushed ring design (Fig. 10) is the apparent failure to get uniform pressure in the groove in the stationary ring. In larger pumps, where the physical size and particular design permits, the use of two sets of regular flat wearing rings in tandem with a large water space between (See Fig. 12) offers the most satisfactory water-flushed ring design. The large water space between the two sets of rings allows uniform distribution of the flushing water to the full 360° of each leakage joint.

In the case of pumps handling gritty or sandy water, the ring construction should provide an apron on which the stream leaving the leakage joint can impinge. Otherwise, the sand or grit in the jet will erode the surface which it hits. Thus, some form of "L" type casing ring, as illustrated in Fig. 9, should be used.

The second installment on the subject of wearing rings will discuss joints with axial clearance, the mounting of rings (both in the casing and on the impeller) and maintenance of wearing rings.

Part 5 of this series will be a second installment in the discussion of wearing rings.

W&SW

Passes Eighty-Eight and Going Strong

Old Timer has operated sewage plant of East Rutherford for 32 years.

William Eigenrauch, one of our oldest subscribers, recently celebrated his 88th birthday—and with no thought of retirement from his position as Chief Operator of the East Rutherford, N. J., sewage treatment plant. He has served the community in that capacity for the past thirty-two years.

Mr. Eigenrauch can boast of being a charter member of the New Jersey Sewage and Industrial Wastes Association, America's first sewage works association. He has belonged to the Masonic Fraternity for 62 years, is a member of the Old Timers Club, and is an exempt fireman of the borough.

We are proud to have Mr. Eigenrauch as a subscriber to *Water & Sewage Works*.

J. R. Hoffert Retires from Penna. Health Department

John Raymond Hoffert has announced his retirement from the Pennsylvania State Department of Health, terminating 35 years of service with the Commonwealth. He retires as Chief Sanitary Engineer in the Bureau of Sanitary Engineering.

Mr. Hoffert first came to the State Health Department in 1919. He was appointed Chief Sanitary Engineer in 1948. A graduate of Cornell University, Mr. Hoffert served successively from 1927 to 1946 as assistant secretary, acting secretary and secretary of the State Sanitary Water Board, and helped launch the Board's Clean streams program.

Mr. Hoffert is chairman of the Central Pennsylvania Section, American Society of Civil Engineers; and represented Pennsylvania as a Commissioner on the Interstate Commission on the Potomac River Basin. He is a member of the AWWA and of the Penna. Sewage and Industrial Wastes Association. From the latter organization Mr. Hoffert received the FS&IWA Bedell Award, given for outstanding service. He is also a member and past president of the Pennsylvania Water Works Association, and has served on a number of national committees concerned with engineering and various phases of stream pollution control.

Tisdale New Engineer-Director of Interstate Comm. on Potomac River

It is reported that Ellis S. Tisdale will assume the duties of Engineer-Director for the Interstate Commission on the Potomac River Basin after January 1st. Mr. Tisdale is a former director of the Sanitary Engineering Div. of the West Va. State Dept. of Health.

Ben. Franklin is credited with having said, "Not until the well is dry do we appreciate the worth of water."

West Va. Water Service Co. Exhibit Useful Public Relations Builder

THE NEW EXHIBIT of the West Virginia Water Service Co., shown for the first time at the meeting of West Virginia Section of the American Water Works Association in Huntington, W. Va., on November 8th and 9th, attracted deserved attention. It is used to portray the different aspects of the water works industry.

Designated "The Water Wheel," the unit on the left is a model which portrays the different classifications of the water supply industry. This is a self-contained unit, provided with water circulation and contains a flowing spigot and flowing waterfalls to represent the source of supply. This unit has been used as a window display and was designed as an eye-catcher for the public.

The unit on the table in the center, comprises a small low lift pump, aerator, over-and-under baffle mixing chamber, settling basin, two gravity filters, clear well, high service pump and elevated tank. This is a scale model of one of our purification plants and is constructed of clear plastic. The low-lift pump circulates water through the model plant and demonstrates the process of aeration, chemical feed, mixing, flocculation, sedimentation, filtration, pumping and filter washing. This unit is used principally as an educational feature and is moved into the classrooms in the Junior High and High Schools to instruct the students in water purification. We are finding that by spending an hour with each class and providing other chemical reagents and chemical equipment we can readily demonstrate coagulation, sedimentation and filtration. With this unit we normally instruct approximately 1,500 students per year. It has also been used in connection with lectures on water conservation to civic groups.

The unit on the right is a circulating dripping faucet, provided with a small pressure pump which will deliver water at approximately 40 pounds pressure through an orifice to provide a dripping or leaking faucet. This has been used as a guessing contest in which visitors at the display were permitted to observe the leakage and fill out a special card with the estimate of the quantity of water leaking in a given period of time. The last time this unit was used in such a contest there were over 5,000 visitors who recorded their guesses. At the end of the period designated the meter was opened and the leakage determined. Letters were sent to all contestants notifying them of the correct answer and three cash prizes were given for the closest guesses.

The three panel back-drop consists of enlarged photographs of different units of our plants, such as the new chemical feed room and laboratory at the Charleston plant and a 3,000,000-gallon distribution storage tank erected to improve water supply service and fire protection in outlying districts.

Ed. Note: Observing the interest shown in the exhibit of the West Va. Water Service Co. at the meeting of the W. Va. Section of A.W.W.A. the accompanying photograph and description was made at our request for publication in W.&S.W.

W&SW

"CAVITATORS"—two batteries of two units in series. In empty unit the wire contact grids are visible.

New Low Cost Treatment System

Introduced at New Holstein, Wisc.

by Dr. KARL L. SCHULZE, Int. Agricultural Products, Inc., Green Bay, Wis.
and HERBERT S. FOTH, Foth and Porath, Inc., Engineers, Green Bay, Wis.

THE SEWAGE treatment plant of the City of New Holstein, Wisconsin, is unique both in design and in the problem posed by the wastes to be treated. It was the problem itself which resulted in the choice of the novel Cavitation System for secondary treatment at New Holstein. It is the first full-scale installation of this method of sewage and waste treatment for a municipality.

Like most small communities, New Holstein needed a plant which could be built at minimum cost. By using the Cavitation System, plant construction costs could be reduced from an estimated $240,000 to roughly $150,000.

Considering domestic sewage only, this plant is comparable in design to one for a city several times the size of New Holstein, the over-sizing being necessary to permit experimental handling of strong industrial wastes during an extended canning season. The domestic waste design population for New Holstein is 3,000, but the total load from the city and the canning factory during the pea canning season is equivalent to municipal sewage of a city of 12,000 persons. The design problem involved these shock loads from the canning factory.

As the consulting engineers, Foth & Porath, Inc., ruled out the practicability of employing trickling filters for secondary treatment after thorough investigation of the problem. To handle the peak load during the extended canning season two large filters would be required, one to be out of service for the greater portion of the year. The community could not afford the financial outlay for a plant designed on this basis.

The activated sludge process, as practiced today, also was economically unsound because of the size of the structures required to handle the peak loadings, resulting in a large initial construction cost.

The Cavitation System had been tested in Wisconsin in pilot plant operations handling various industrial wastes. The results were so favorable when measured in terms of over-all first cost and cost per pound of B.O.D. removed, that the New Holstein plant was designed for the Cavitation System with the agreement that the equipment would be replaced with conventional equipment if performance was not up to the standards established.

Tests conducted by the Wisconsin State Board of Health laboratories show the following: Raw sewage to treatment plant—260 p.p.m. 5-day B.O.D.—final effluent from the treatment plant—11.5 p.p.m. 5-day B.O.D. The plant has, therefore, been approved only for treatment of domestic waste to date.

Basic Plant Design

The New Holstein plant serves a design population of 3,000 with a maximum flow of 0.225 M.G.D. corresponding to a load of 510 lbs. B.O.D. per day (see Table III). During the canning season, especially during the pea canning period, an additional load of 1500 lbs. B.O.D. per day was anticipated. Since it was agreed to handle this additional load on an experimental basis, the maximum design load had to be increased to a total of 2010 lbs. B.O.D. per day.

To accommodate the maximum load the settling tanks and digester were increased from the sizes required for domestic waste alone, and the number of Cavitator (aerator) units and tanks were increased from two to four, two being the number required for the domestic waste load alone.

As can be seen on the flow diagram (Fig. 1), raw sewage enters the primary clarifier after passing through a comminutor. The raw sludge is discharged by a time-controlled pump to the digester. The primary effluent flows by gravity into the wet well and

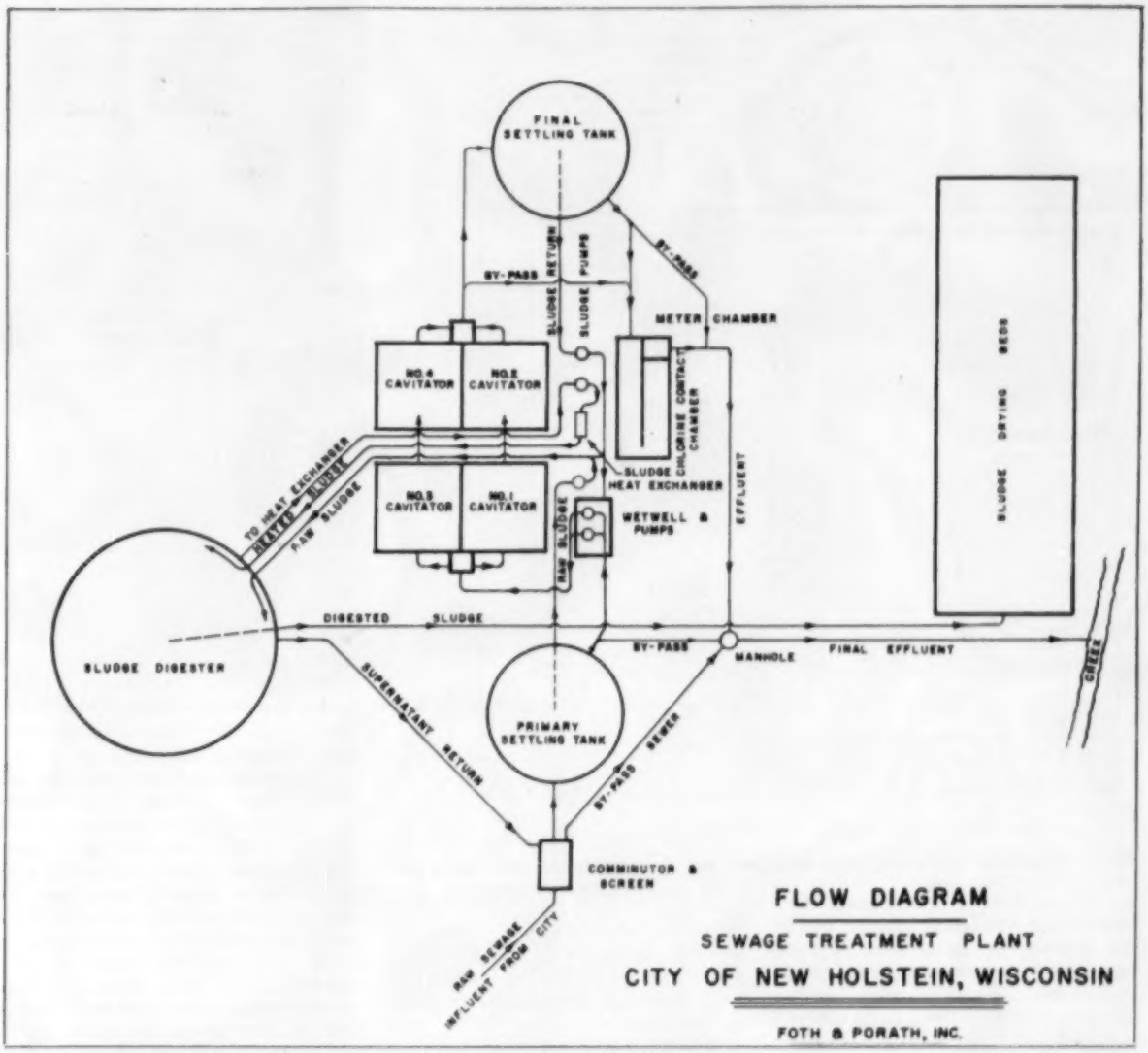


Fig. 1.—Flow diagram of combination sewage and waste treatment plant, New Holstein, Wis.

is fed into the Cavitation System by two float-controlled pumps. The effluent from the Cavitation (aeration) tanks passes through the final clarifier into the chlorination chamber or directly into the creek. A portion of the sludge from the final clarifier is recirculated by being returned to the wet well and the remainder is wasted to the digester.

The control of the amount of sludge returned and wasted is effected by a valve and an adjustable time switch which operates the sludge pump. The supernatant from the digester is returned to the comminutor chamber.

Equipment is sized as follows:

Primary Clarifier: 26 ft. dia. x 7 ft. S.W.D. Capacity 27,900 gallons. Detention period 1 hour, 30 min.

Cavitation System: Two units of two-stage tanks, with detention period of two hours each. Air requirements—120 cu.ft. of air per pound of B.O.D. removed per day; 15 cu.ft. per pound of B.O.D.

Capacity of tank (each) 2,480 cu. ft. Tank sizes (each) 16'6" sq. x 10'0" deep.

Final Clarifier: 26 ft. dia. x 7 ft. S.W.D. Capacity 27,900 gallons. Detention period 1 hour, 30 min.

Digester: 30,000 cu.ft. storage capacity (12,000 cu.ft. domestic load, 18,000 cu.ft cannery waste load).

Sludge Beds: 10,472 sq. ft. total, including existing bed area of 4,872 sq. ft.

The equipment, except for the Cavitation System supplied by Yeomans Brothers Co. of Melrose Park, Ill., is standard: comminutor, Chicago Pump Company No. 10A; primary and final clarifiers, Yeomans Brothers Co.; pumps, Fairbanks Morse & Co.; metering equipment, Builders Providence; digester and sludge heat exchanger, Dorr Co.

The Cavitation System

It is believed from observations in the laboratory, shop, and field over a period of approximately three years, that the Cavitator unit creates and utilizes pressure differentials in the liquid under treatment so that the oxygen introduced into these regions can be utilized with the highest efficiency and at the greatest possible speed.

The forces of these pressure differentials are believed to be like cavitation, which has been observed and analyzed for some time. Cavitation is completely undesirable in liquid pumping and flow systems because it

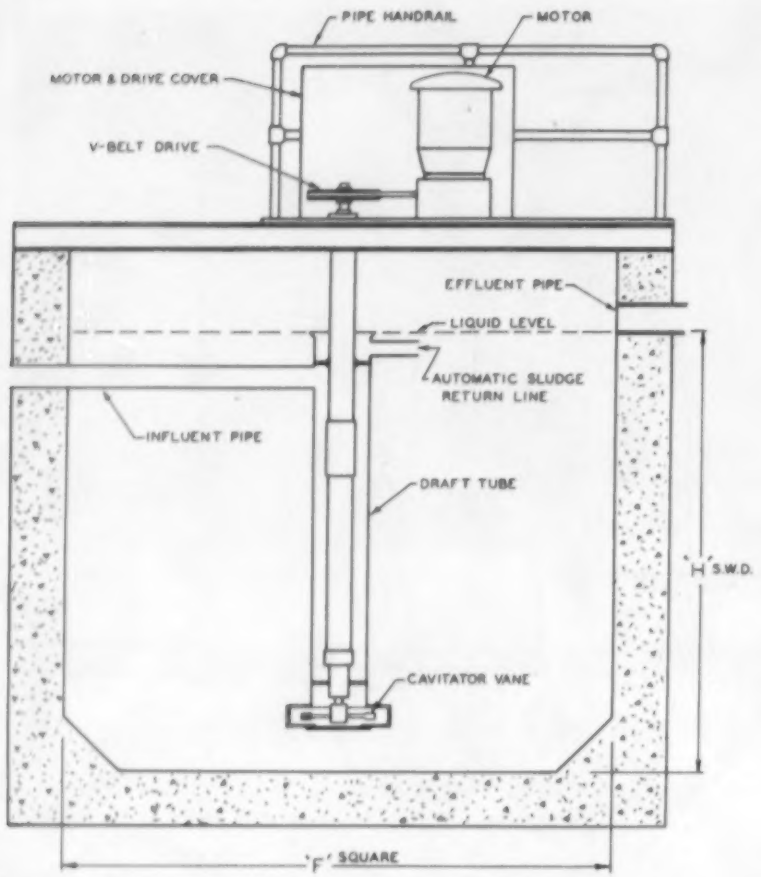


Fig. 2—"Cavitator"—showing down-draft tube and air recirculation vane.

lowers the efficiency of the pumping system. Emphasis in the past has been on reduction or limitation of cavitational effects in any instance where a solid impeller travels through a liquid. The Cavitation System is in contrast to this point of view where pumps are concerned, and cavitation-like forces are utilized to achieve an accelerated oxygen utilization rate—the Cavitation System utilizing at least 25% of the available oxygen in the air in contrast with conventional aeration equipment which utilizes only about 5%. This oxygen utilization rate substantially lowers the detention period and only four hours in the aeration stages are required.

Each of the four Cavitation tanks has a capacity of 18,500 gallons, or 74,000 gallons total. As indicated on the flow diagram (Fig. 1) two pairs of these tanks are operated in series: Numbers 1 and 2, and 3 and 4. Primary effluent is fed into the downdraft of the first stage Cavitator from which the overflow passes over an adjustable weir into the downdraft of the second stage Cavitator. Under normal conditions, with municipal waste alone or municipal waste plus lima bean or apple waste from the canning factory, only two Cavitators are in operation. During the pea canning season all four units are placed in operation.

The Cavitator units in tanks No. 1 and 2 were developed by one of the authors (Dr. Karl L. Schulze) as the result of a 3-year research program carried on by the International Agricultural Products, Inc., Green Bay, Wis. The units in tanks No. 3 and 4 are an advanced type developed by the Yeomans research engineering staff in cooperation with Dr. Schulze.

The complete Cavitator assembly (Fig. 2) consists of a vertical draft tube with lower diffusion plate, the draft tube having openings for connection to the influent pipe. The Cavitator rotor assembly is of the multi-blade type, supported by an adjustable ball thrust bearing mounted at the motor level. The rotor is mounted on stainless steel shaft and the entire unit including draft tube is supported from a structural steel bridge.

As soon as the rotor exceeds a certain critical speed, air is drawn in from the atmosphere through a vertical hollow tube, and is dispersed into the liquid. Visualizing the operation of the equipment, the rotor creates a zone of cavitation in its turbulent trail and the air moves in to fill the areas of rarified underpressure. The moment the air leaves the rotor it undergoes very considerable changes of pressure and is finely dispersed by turbulence. Simultaneously the rotor also acts as a pump.

Raw waste (primary effluent) and mixed liquor is drawn down through the downdraft tube and mixed intimately with the air. The rotor openings are of ample size to prevent clogging. In clear water it can be seen that the air-liquid mixture spreads like a spiral-shaped milky cloud towards the tank walls and then starts to move upward. The whole mass of liquid in the tank rotates and the foam on the surface moves constantly toward the center until it is destroyed as it enters the intake port of the downdraft tube. The amount of air which

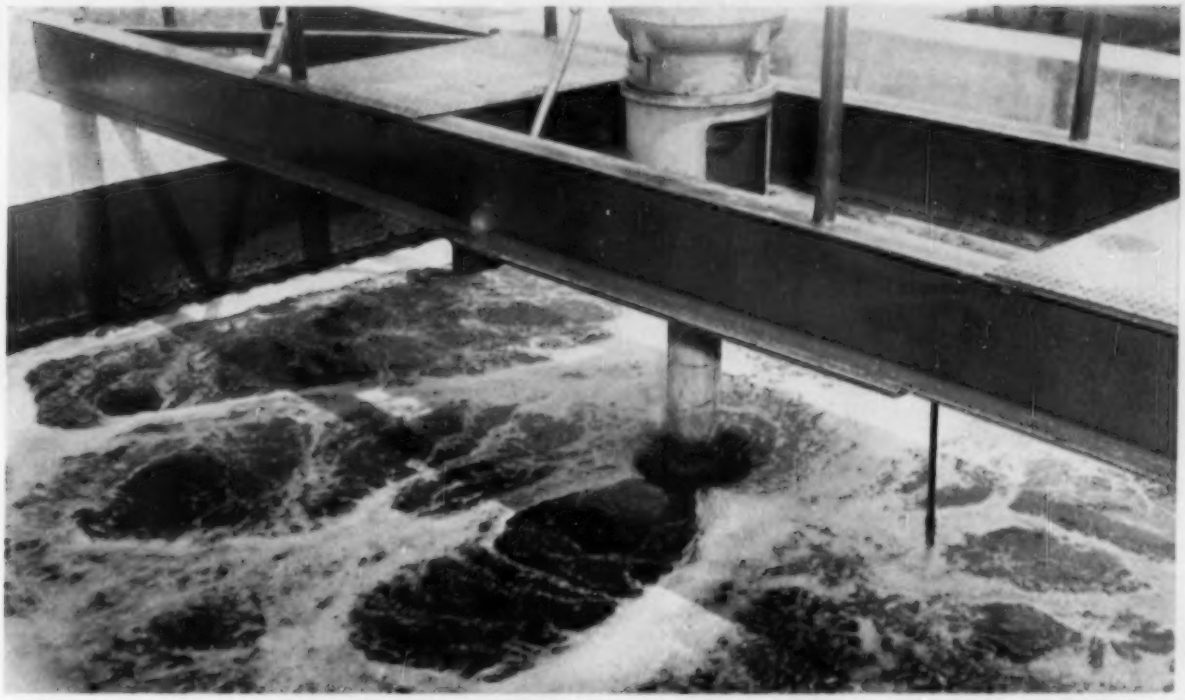
TABLE I

Test results at New Holstein, Wis. — Two-stage Cavitation System

Municipal waste alone—Two Cavitators operating—Air Supply: 28,800 cu. ft. per day. Cavitator tank volume: 37,000 gal. or 4,960 cu. ft.

All samples are 24-hour composites

Date 1954	Total flow 1000 gpd	Prim. effl. B.O.D. ppm	Final effl. B.O.D. ppm	Load on Cavitators lb B.O.D./ day	Lb B.O.D. rem./day	Air per lb. B.O.D. rem./day cu. ft.	B.O.D. removal in %	Remarks
May								
24	105	204	21	178.5	160	180	90	
25	100	306	24	255	235	122.5	92	
26	105	180	15	156	143	201	92	
30-31								3 days composite
June 1	111	201	14	186	173	166	93	3 days average flow
5-6								3 days composite
7	116	132	6	128	122	235	95.5	3 days average flow
8	111	186	9	172	163.7	176	95.2	
7-8	111	220	10.3	204	194.5	148	95.3	State test
9	122	138	6	140	132	218	95.7	
12-14	103	150	6	129	125	230	96	3 days composite
								3 days average flow



"CAVITATOR" at close range, showing down-draft tube leading to cavitation and recirculation vane.

is being entrained depends on the size and the shape of the rotor, the r.p.m., and the water depth.

The entire unit is self contained and hangs freely from the bridge. In case of servicing it can easily be pulled up and then lowered again. The hollow shaft is completely housed, and the housing carries water lubricated bearings.

Plant Performance

From April 1 until June 28 only the first two Cavitators were operating, treating municipal wastes. The 24-hour composite samples were taken from the primary effluent and from the final effluent for B.O.D. tests. The mixed liquor and the final effluent were also checked for dissolved oxygen. The results of these tests are shown in Table I. The highest total load during this period was 300 lbs. B.O.D. per day, corresponding to a load of 255 lbs. B.O.D. per day on the Cavitation System aeration phase. The amount of air used per lb. of B.O.D. removed was 122.5 cu.ft. minimum, demonstrating the efficiency of the process. The B.O.D. of the final effluent was always below 30 p.p.m. and for most of the period, below 20 p.p.m. The final effluent carried 1 to 3 p.p.m. dissolved oxygen.

On June 29 all four Cavitators went into operation in order to treat the heavy shock load caused by the pea wastes. B.O.D. tests show that during this period the load on the aeration phase of the Cavitation System went up to 1,732 lbs. B.O.D. per day. From the test data (Table II) is can be seen that the effluent B.O.D. varied from 102 to 372 p.p.m. For the major part of the canning period the B.O.D. reduction was in excess of 80%. During this period our tests proved that there was no dissolved oxygen present in the mixed liquor. As Fig. 3 shows, the air supply dropped to as low as 62 cu.ft per lb. B.O.D. per day load on the aeration system. Apparently the initial design of the Cavitators did not provide sufficient air supply to maintain the normal plant efficiency. Continued operation under these overload conditions resulted in a gradual drop of the efficiency of the plant and the

TABLE II
Relationship Between Air Supply and % B.O.D. Removal

Date 1954	Load on Cavitation System lbs.B.O.D./day	Air in cu. ft. per Lb. B.O.D. load per day	B.O.D. Removal in %	Remarks
May				
24	178.5	161	90	
25	255	113	92.0	
28	156	184	92.0	May 24-June 14 Municipal waste alone 2 Cavitators running Air Supply: 20 cfm or 28,800 cu.ft./day
June				
1	186	155	93.0	
6	128	224	95.5	
7	172	167	95.2	
8	204	141	95.3	
9	140	205	95.7	
14	129	223	96.0	
July				
7	800	111	93	July 7-28
13	912	97.5	86.1	Municipal waste plus
21	970	92	84.2	pea waste.
22	1000	89	81.5	4 Cavitators running.
26	976	91	80.3	Air Supply: 62 cfm or
27	1436	62	64.6	89,300 cu.ft. per day
28	1180	75	62.7	

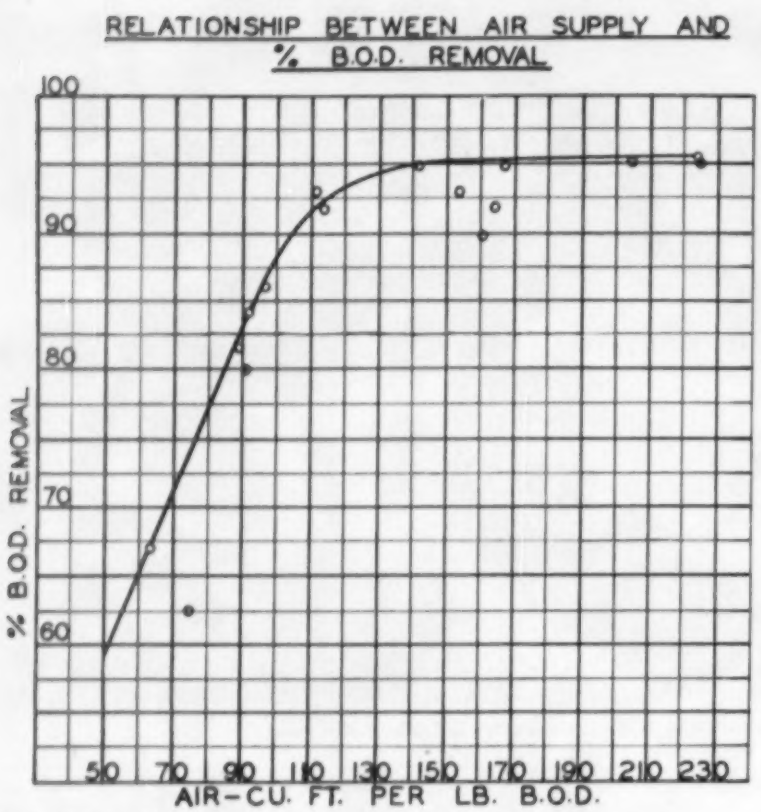


Fig. 3—Relationship between air supply and B.O.D. removal reveals economy operating zone at 110 to 130 cu. ft. per pound of B.O.D. to Cavitator.

results obtained were not sufficient to meet the State requirements established for the receiving stream. Therefore, necessary modifications are being undertaken which are expected to permit production of an acceptable effluent under maximum loading.

On August 3, the pea canning stopped and within one week the plant again was operating with only two Cavitators. Even when lima bean wastes (Sept. 1-27) and apple wastes (Oct. 4-Nov. 12) were contributed in addition to the domestic load, it was unnecessary to use more than the two Cavitators.

TABLE III
Design Data

The New Holstein plant was designed on the following basis.

1. Domestic population load:
   - 1940 Population — 1,502
   - 1950 Population — 1,833
   - Design Population — 3,000

   Domestic Flow — 0.225 M.G.D. and B.O.D. loading @ .17#/Cap./Day or 510#/Day.

2. Cannery:

   Maximum pack of 7,500 No. 303 cases per day of peas;
   1,500 No. 2 cases per day of lima beans;
   600 No. 10 cases per day apples.

   Average Daily Pack (estimated)—6,000 cases per day

   Cannery Flow @ 25 Gal./case or 150,000 G.P.D. B.O.D. loading @ 1500#/Day @ population equivalent of 9,000 persons.

	Design Population	Population Equiv.	Ave. Flow G.P.D.	Ave. Flow G.P.M.	16 Hr. Flow Rate G.P.D.	16 Hr. Flow Rate G.P.M.	B.O.D. ppm	B.O.D. #/Day
Domestic	3,000	3,000	225,000	156	297,000	206	272	510
Cannery	.....	9,000	150,000	104	150,000	104	1200	1500
TOTAL	.....	12,000	375,000	260	447,000	310	642	2010

Relationship Between Air Supply and Per Cent B.O.D. Removal

To confirm earlier laboratory and shop tests on the amount of air required for handling a definite load, data were compiled from the plant (municipal and pea wastes) performance, plotted as shown in Fig. 3. The amount of air supplied per pound of B.O.D. per day (load on the Cavitation System) was plotted against per cent B.O.D. removal. The figures are given in Table II.

This graph (Fig. 3) is interesting in that it shows a definite relationship existing between air supply and per cent B.O.D. removal, and the critical point to be at about 110 cu.ft. of air per pound B.O.D. per day load on the Cavitation System. This means that under the existing conditions we are obtaining over 90% B.O.D. removal with the Cavitation System, as long as we provide 110 cu.ft. of air per pound B.O.D. per day load on the System, and the plant is properly operated otherwise. This is evidence of the high oxygen transfer efficiency of the Cavitation System. As soon as necessary test equipment is available, it is planned to determine the actual oxygen transfer efficiency under various conditions—the tests to be conducted in the laboratory and field.

Summary

At the New Holstein sewage treatmant plant, the first full-scale operation of the Cavitation System, it has been shown that this System is capable of providing consistently over 90% B.O.D. removal with an air supply of only 110 cu.ft. per pound of B.O.D. per day figured as load on the Cavitation System. Municipal waste alone and combined with lima bean and apple wastes from the local canning factory, have been treated equally successfully. During the pea season with a load 6 to 7 times more than normal, it was found that the most important limiting factor was the insufficient air supply. During the seven months of operation at New Holstein, there has been no clogging of the Cavitators, nor has any difficulty with foaming been experienced.

Operation costs compare favorably with the activated sludge process, specific figures on operating costs being $12.80 per day during the pea season when all four Cavitators are running, and $6.40 per day during normal operation with two Cavitators running.

W&SW

Canadian Sewage and Sanitation Meeting in Montreal

Attendance over 500 at convention where current developments were emphasized

THE Canadian Institute on Sewage and Sanitation held its 27th Annual Convention in Montreal, Quebec, October 25-27, 1954. This, the first meeting of the Institute in Montreal, drew a high registration of 501. An excellent program was planned to provide technical information on a wide variety of topics.

New Officers Elected

New officers elected to serve for the coming year are:

President—N. S. Bubbis, Acting Gen. Mgr., Greater Winnipeg San. Dist., Winnipeg, Man.

Vice-President—C. G. R. Armstrong, Cons. Engr., Windsor, Ont.

Past-President—A. E. Chalmers, City Engr., Peterborough, Ont.

New Trustees—R. V. Anderson, City Engr., Toronto, Ont., and E. E. W. Oke, City Engr., Waterloo, Ont.

Federation Director—Nicol MacNicol, Commr. of Works, Forest Hill, Ont.

Representative Equip. Assn.—Charles E. Napier, Napier Co. Ltd., Toronto, Ont.

Business Meeting

It was voted to change the constitution of the Institute, and to increase dues to $3.00 per year, in order to operate an office in conjunction with the Canadian Section of the A.W.W.A. (which already has approved such action). A joint administrative office is to be set up; it will function to provide better service in the distribution of information to both organizations.

Social Events

The City of Montreal acted as host at an enjoyable reception held at the Chalet which overlooks the city.

The Canadian Sanitation Equipment Association contributed to the hospitality of the convention in sponsoring both the "Club Room" and the entertainment at the Institute's annual banquet.

Secretary Wisely Attends

A warm welcome was extended to F.S. & I.W.A. Secretary Wisely, who distinguished himself as guest speaker at the banquet. He described, and illustrated with color slides, his recent visit to Europe. In a busy itinerary, he attended technical meetings, called on many familiar "names" in the profession, and saw many treatment plants.

This was Secretary Wisely's last meeting with a member Association. The Institute presented him with a silver tray and offered its sincere wishes for success in his new secretaryship.

Norman J. Howard Retires

Past-President of the Canadian Institute, Norman J. Howard, has announced his retirement from his position as Director of Water Purification for Metropolitan Toronto. The Institute recognized his many contributions to the field of sanitation by presenting him with a gift of silver.

All events at this highly successful meeting were well attended. Of the total registration, there were 140 ladies. A special ladies' luncheon was provided. An afternoon inspection trip by bus to places of interest in nearby Westmount, Lachine, and Cote St. Luc was offered to members and guests.

Retiring President
A. E. Chalmers

Incoming President
N. S. Bubbis

Vice-President
C. G. R. Armstrong

Secretary-Treasurer
Dr. A. E. Berry

Secretary's Secretary
Mrs. Mae Grove

F.S. & I.W.A. Director
Nicol MacNicol

New Trustee
E. E. W. Oke

Equip. Assn. Chmn.
J. B. Kinney

Equip. Assn. Rep.
Charles E. Napier

Presentations

F.S. & I.W.A. Secy. Wisely receives silver tray.

Norman Howard accepts gift of the Institute.

North Carolina Water & Sewage Meeting in Asheville

Thirty-fourth Joint Convention of AWWA Section and S&IW Association held in Asheville with registration of 255

THE North Carolina Section, AWWA, and the North Carolina Sewage and Industrial Waste Association held their thirty-fourth annual Joint Convention in Asheville, N. C., on November 8-10, 1954. Total registration at this highly successful meeting was 255. Winston-Salem was selected as the location for the next annual meeting.

Retiring Chairman
J. M. Jarrett

Income Chairman
S. E. Harris

Vice-Chairman
R. S. Phillips

Secretary-Treasurer
W. E. Long, Jr.

New Trustee
H. J. Siebert

New Trustee
J. C. Stowe

Retiring AWWA Dir.
G. S. Rawlins

Incoming AWWA Dir.
W. M. Franklin

AWWA President
Dale Maffitt

Retiring FS&IWA Dir.
P. D. Davis

Income FS&IWA Dir.
E. C. Hubbard

Local Chairman
Floyd Padgett

New Officers

The following officers were elected to serve for the coming year:

Chairman—S. E. Harris, Dept. of Water & Sewerage, Winston-Salem.

Vice-Chmn.—R. S. Phillips, Asst. Supt., City Water Dept., Charlotte.

Secy.-Treas.—W. E. Long, Jr., San. Engr., State Stream San. Comm., Raleigh.

Director, AWWA—W. M. Franklin, Supt. of Water Dept., Charlotte.

Director, FS&IWA—E. C. Hubbard, Exec. Secy., State Stream San. Comm., Raleigh.

New Trustees—H. J. Siebert, Sales Engr., Neptune Meter Co., Charlotte; and J. C. Stowe, Supt., Hamlet Water Co., Hamlet.

The retiring officers include:

J. M. Jarrett, Past Pres., San. Eng. Dir., State Bd. of Health, Raleigh; George S. Rawlins, AWWA Director, Vice-Pres., J. N. Pease & Co., Charlotte; P. D. Davis, FS&IWA Director, Piatt & Davis Cons. Engrs., Durham.

Honors and Awards

The George W. Fuller Award of the AWWA Section was presented to George S. Rawlins in recognition of his contributions advancing the work of the Section and in the promotion of high professional standards.

Life Membership was presented to Messrs. George Moore, Supt. of Utilities, Albemarle; and to Martin Swartz, Supt., Hamlet Water Co., Hamlet, both of whom have been members for more than thirty years.

The Maffitt Membership Cup was presented to Mrs. Ethel Goodwin Young, Secy. to Director, Public Utilities Dept., Raleigh, for obtaining the largest number of new members for the AWWA Section.

Technical Program

Approximately half of the technical program was devoted to papers of water works interest, and half to papers on sewage and industrial waste topics. Asheville's water system was described by Thad. C. Burnett, Consultant, Asheville City Water Works. The city furnished bus transportation for an inspection trip to its new water supply reservoir.

Experiences with higher rates of water filtration was described by Wade G. Brown, Asst. Supt., Water

& Sewer Dept., Durham, N. C. Mr. Brown also is lecturer in Sanitary Engineering, College of Eng., Duke University.

The use of water for irrigation purposes was described by Beverly C. Snow, Chief Engr., Div. of Water Resources, State Dept. of Conservation and Development, Raleigh, N. C.

The development of adequate water and sewer rate structures was the topic of a paper presented by Richard Hazen, Hazen and Sawyer, Engineers, New York, N. Y.

Operation of the municipal sewage treatment plant at Salisbury, N. C., was reviewed in a paper by John N. Leslie, Jr., Plant Supt., Salisbury.

Water and Sewage Symposium

One afternoon was devoted to a water and sewage works symposium. Stanford E. Harris, Supt., Water & Sewage Dept., Winston-Salem, presided at the symposium, and Geo. S. Moore, Dir. of Utilities, Albemarle, served as moderator.

Papers were presented on the following topics:

"Water and Sewer Service Connection Charges" by D. J. Gore, Supt., Public Works Comm., Fayettesville.

"Demand Charges, Sprinkler Charges and Hydrant Rentals" by D. M. Williams, Supt., Water & Sewer Dept., Durham.

"Sewer Service Charges Applying to Unusual Commercial and Industrial Wastes," by R. S. Phillips, Asst. Supt., Water Dept., Charlotte.

The symposium continued with an open discusion period during the last session of the meeting. This session also included the presentation of an excellent motion picture film titled "Better Fishing."

Social Events

The city of Asheville was host at a barbecue and evening of entertainment at the municipal auditorium, with mountain music and square dancing lasting into the night. At the association banquet and dance, held the last evening of the convention, Walter Smith, representative of the Metropolitan Life Insurance Co., Rutherfordton, was guest speaker.

A special program for the ladies included a luncheon followed by an inspection trip to the Biltmore Industries Plant.

President Maffitt Guest Speaker

At the Convention's honorary luncheon for national officers, Dale E. Maffitt, Des Moines, Iowa, AWWA president, was the guest speaker. President Maffitt reviewed the growing importance and recognition of our country's water works industry. He strongly recommended local emphasis on the employment of young engineers, chemists, and bacteriologists; this "new blood" should attend technical meetings and participate in association activities.

The joint convention of North Carolina water, sewage and industrial waste associations was informative and stimulating. It well exemplified the values cited by the guest speaker as contributing to technical knowledge and gain through personal contacts.

W&SW

Clay Pipe Is Facing Material in New Office Building

An unusual use of vitrified clay sewer pipe and of outsize brick are design features of the new office building of the Pacific Clay Products Co., Los Angeles, Calif. The entire building is faced with a special brick made of sewer pipe clay, and produced for the purpose by one of the owner's plants.

The large panel illustrated is actually a 3-in. thick veneer of sections cut from 4-ft. lengths of 38-in. diameter clay pipe. Three sections of facing were cut from each length of pipe. The pipe sections form a serpentine pattern, and white joinery lines between horizontal courses emphasize the effect.

SEWER PIPE PANEL—Vitrified clay pipe makes this impressive panel, 44 ft. wide and 15 ft. high.

Note, at the left end of the panel, the use of a length of a standard 39-in. diameter sewer pipe section as a planting box. The offices are air-conditioned and equipped with an FM music system.

Engineers Club of Kansas City Establishes Grant-in-Aid Plan

From E. L. Filby, Chairman of the Student Assistance Committee of the Engineers Club of Kansas City, we have received an announcement that the Club has established a Grant-in-Aid scholarship fund to help finance students from the Kansas City area through college engineering courses.

"Your Part in the Training Program for Tomorrow's Engineers" is the title of a booklet issued by the Club to describe the program and to answer questions from employers, school counselors, and students. The plan is effective immediately. Donations have been secured from engineering firms in the Kansas City vicinity which will enable the Engineers Club to make a substantial contribution to the engineering future of a number of young men. The Club plans to guide sponsored students throughout their study, and to aid them in securing summer vacation employment in Kansas City engineering or business firms.

For information write to E. L. Filby, Black & Veatch, 4706 Broadway, Kansas City 12, Mo.

Stabilization of Polluted Waters

Basic factors involved are the organisms, the food, and the environment

Part 2—The Food and the Environment

by H. HEUKELEKIAN

Dr. Heukelekian is Professor of Research Eng., Agr. Expt. Sta., Rutgers Univ., New Brunswick, N. J. In this paper, he reviews fundamental principles in the stabilization of domestic sewage, industrial wastes, or mixtures of the two. His discussion applies to changes taking place in biological treatment plants or in receiving streams.

PART 1 of this two-part article, published in our December issue, discussed the organisms involved in stabilization of polluted waters. Food and environmental conditions which constitute basic factors of equal importance are the subject of Part 2.

Food

The second basic factor in the biological treatment of wastes is related to the type and concentration of food materials. As stated before there are only a few compounds which microorganisms cannot attack and utilize as food. The rate at which these materials are attacked and utilized depends on the nature of the compound, the organisms, and the environmental conditions.

Some food materials are more readily available than others. The availability of the food material is determined primarily by its chemical composition, but a knowledge of the chemical composition is not sufficient for the prediction of its availability. Nor is availability related to the energy level of a compound. For instance, sugar, cellulose and lignin are all compounds of C, H, and O and have practically the same energy values, but their availability is greatly different; sugar being very readily available, cellulose less available and lignin practically unavailable as a source of food for microorganisms.

The problem is not necessarily one of particle size. Although sugar is in solution, and cellulose is a larger size molecule existing only in suspension of various sizes, this does not explain the difference between cellulose and lignin. For a given material, however, the smaller the state of subdivision the greater is the availability.

Food Utilization

We are immediately confronted with the mechanisms whereby microorganisms are capable of utilizing the food materials. All food materials must enter the cell through its protoplasmic membrane before they can be utilized within the cell. Food materials must, therefore, be in solution before they can diffuse through the cell membrane. Those wastes in which the organic materials are already in solution can be utilized immediately and directly.

Wastes containing suspended matter cannot diffuse through the cell until they are first hydrolyzed by enzymes (excreted by the microorganism) and converted into soluble forms. A great number of hydrolyzing enzymes are produced by microorganisms, and the enzymes are specific for converting various types of organic materials into soluble forms. For instance, cellulose is hydrolyzed by cellulase into cellobiose, the disaccharide, which in turn is hydrolyzed by cellobiase into glucose.

It might be expected that the necessity of preliminary hydrolysis of larger particles would decrease the rate of utilization of these materials and that the larger the size of a particle the longer it will take for it to be decomposed. This is not, however, universally true. There are instances where the rate of hydrolysis is greater than the rate of assimilation of the hydrolysis products by the microorganism, e.g. the rate controlling factor is not hydrolysis but is assimilation.

Liquefaction and Gasification

An example of this may be found in sludge digestion. The hydrolysis or liquefaction phase tends to proceed faster than the assimilation or gasification phase, which results in the accumulation of intermediate products such as organic acids and these in turn slow down the gasification. An example of the opposite situation—where hydrolysis may become the rate controlling factor—may be found where there is no immediate contact between the organism and the solid suspended particles.

The enzymes secreted by the cell become diluted in the surrounding substrate, thereby slowing down the rate of hydrolysis. The products of hydrolysis in turn are dispersed throughout the substrate, and the diffusion into the cell and consequent utilization is retarded. It will be found in such cases that the attachment of the bacteria to the suspended particles, as in the case of cellulose fibers, greatly accelerates both hydrolysis and assimilation phases.

Not all soluble materials which are readily diffusible are assimilated or utilized rapidly. The oxidation of ammonia to nitrites and nitrates by nitrifying organisms can serve as an illustration of this phenomenon. Ammonia is readily diffusible and is generally present in sewage. Yet the conversion of ammonia to nitrates requires 10 to 12 days of storage under aerobic conditions. This is associated with the slow rate of multiplication of the nitrifying organisms. Once an active nitrifying flora is established, as in trickling filter slimes and activated sludge floc, then nitrification can take place rapidly.

Degradation Process

After the soluble food materials diffuse through the cell membrane, the process of degradation begins. For instance, a molecule of sugar is dissimilated through a complicated series of steps liberating energy and producing the final building blocks which then are synthesized into cellular materials of the same type as the original compound entering the cell, or into entirely different compounds.

Only a portion of the energy liberated from the intracellular breakdown of the compound diffusing into the cell is actually utilized in the synthetic

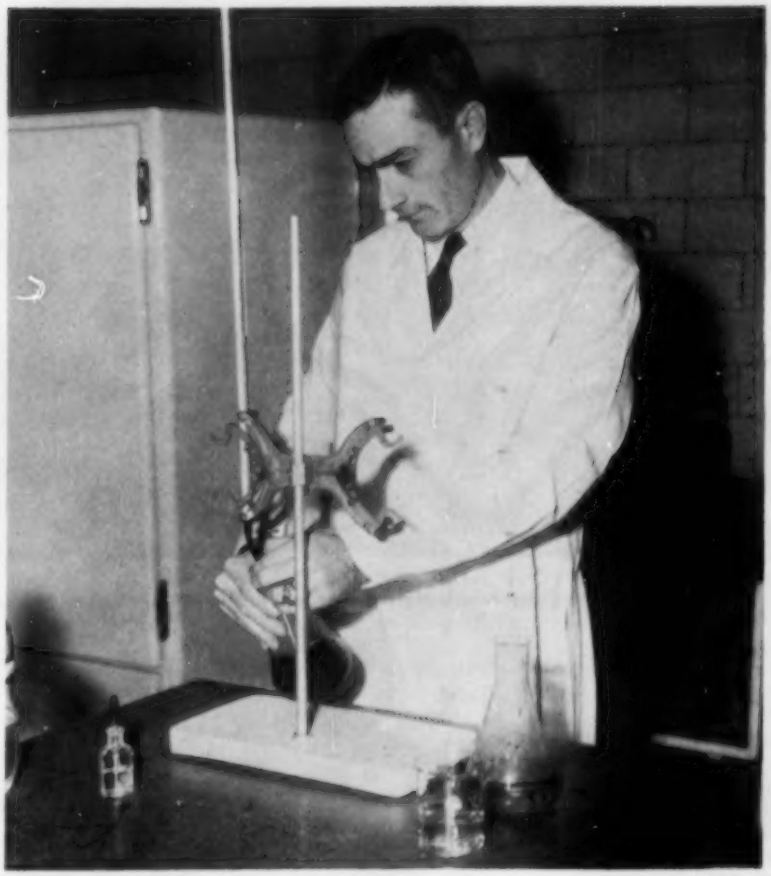
stage of metabolism. The remainder either is dissipated as heat or a part of the energy value of the original compound may appear in the intermediate products due to the incomplete breakdown. This is the case in anaerobic processes where, for example, the breakdown of sugar stops at alcohol or acetic acid stage; at this stage, it still contains a great percentage of the original energy value of the sugar. Under aerobic conditions, on the other hand, the breakdown of food materials is complete and there are no energy values left in the end products, CO_2 and water.

Whether the breakdown of organic material takes place under aerobic or anaerobic conditions, it should be kept in mind that a certain amount of the organic material that is decomposed is recovered as microbial material. This material should be considered as one of the products. The quantity of microbial material produced is considerably greater under aerobic than under anaerobic conditions. In either case, however, a cell material is produced which is different in composition than the food material utilized, e.g. the compounds serving as food are completely transformed and new compounds are thus produced which are peculiar to the microorganism itself.

The complete destruction of wholly available food materials, even under strictly aerobic conditions, is an impossibility. Some organic material remains as a residue in the form of microbial growth. When the food is not completely available, there are additional amounts of residual organic materials left in the substrate.

Digestion by Enzymes

The breakdown and synthetic processes within the cell are also brought about by a number of enzymes within the cell. These are similar to the hydrolytic enzymes involved in the digestion of insoluble organic materials outside the cell. The hydrolytic enzymes in the substrate can readily be separated from the cells themselves by filtration through bacterial filters, and the corresponding hydrolytic reactions can be brought about by these enzymes alone in the complete absence of bacterial cells (although not at as rapid a rate). Intracellular enzymes also can be isolated by crushing the cells, and a number of breakdown reactions have been brought about in the absence of living cells at a slow rate, such as the conversion of sugar to alcohol by the enzyme-zymase of yeasts. Certain conditions have to be rigidly controlled, but even under optimum conditions reactions of this type brought about by pure enzyme systems are slow and incomplete.



PFT Photo

LABORATORY CONTROL—For best operation of sewage sludge digesters, laboratory tests are needed. Volatile acids titration is being made.

Even a completely available material may not be utilized by microorganisms if certain additional elements that are required are absent or deficient. For instance, a pure solution of sugar in distilled water is decomposed at a very slow rate by microorganisms. This is due to the fact that sugar contains only carbon, hydrogen, and oxygen; the microbial cell constituents in addition to these elements consist of nitrogen, phosphorus, sulfur, and a number of other elements in smaller quantities.

Nitrogen and phosphorus are the essential protoplasmic constituents, a deficiency of which will limit growth. The carbon, nitrogen, and phosphorus ratio of the food or waste materials are, therefore, important considerations in establishing optimum conditions for biological treament of wastes in which the ratio is too wide. In terms of B.O.D., it has been found that for every 100 parts of 5-day B.O.D., 5 parts of nitrogen and 1 part of phosphorus should be present in the waste or be added artificially to the waste, in case of deficiency, to bring up the ratio to these values.

Work-Load of Organisms

The concentration, quantity and rate at which food is supplied to the microorganisms has an important bearing on the rate of activity. We have developed certain norms for loading of different biological treatment processes. These maximum levels may be inherent in the inability of microorganisms to do additional work; or to adjust themselves to a higher population level, commensurate with the higher amounts of food; or these limitations may be the indirect effect of the higher loadings creating unfavorable conditions for bacterial multiplication.

For example, a loading of 35 to 45 pounds of B.O.D. per 1000 cu. ft. of aerator capacity has been accepted as normal for the activated sludge process. Lately, evidence is accumulating from laboratory and plant scale operations that these loadings can be increased to as much as 100 to 200 pounds of B.O.D. per 1000 cu. ft. of

Hardinge Photo

DIGESTION PROCESS—The anaerobic treatment of sewage sludge is utilized on large-scale in modern units. These are at York, Pa.

aerator capacity, provided that certain conditions are met. These conditions refer to the ability to supply increased oxygenation capacity to meet the additional demand imposed, and also to the ability to maintain a high concentration of mixed liquor suspended solids (greater amount of seed material).

A similar situation is developing in conjunction with sludge digestion. The normal loading of 0.1 pound of volatile solids per day per cu. ft. of digester capacity (which was held as the upper limit of loading for years) is being exceeded tenfold, indicating that the ability of microorganisms to do work has been greatly underestimated. The conditions necessary to accomplish these high loadings appear to be feeding of concentrated sludge, intimate mixing, and continuous feeding.

The fact that microorganisms do not require rest periods was successfully exploited by Halvorson some years ago in conjunction with the development of high rate filters. The practice of resting trickling filters was merely a traditional carryover from the operation of intermittent sand filters and contact beds where rest periods were necessary for the restoration of aerobic conditions. Again the practice of pumping sludge to a digester once or twice a day is based on certain extraneous considerations; greater frequency of feeding or continuous feeding may promote a more intensive bacterial activity and avoid periods of glut and starvation.

Environmental Conditions

The third group of factors affecting the rate of microbial activity, and consequently the rate of biological stabilization of wastes, relates to the environmental conditions. In this area the greatest amount of information is available. Consequently these conditions are subject to control. Briefly, the important factors in this group are the pH value, temperature, oxygen supply, and contact between the food and the organisms.

The pH value of a waste may be too high or too low initially. For an aerobic treatment process there is a fairly wide band of pH values, varying from 6 to 8, in which rates of biological activity are not materially affected. In an anaerobic process involving methane fermentation, the optimum pH value is restricted to a much narrower range—generally varying between pH 6.8 to 7.4.

Anaerobic and Aerobic Conditions

Under anaerobic conditions, the pH value has a tendency to decrease during the digestion, depending upon the nature of the compound and buffering value of the waste. Wastes containing a large proportion of carbonaceous materials in relation to nitrogenous materials have a tendency to become more acid during fermentation. Wastes containing carbonates, bicarbonates, phosphates, and organic matter that may serve as buffers do not undergo a great change in pH value. Initial adjustment of the pH value as well as adjustments during the course of treatment, as they become necessary, may be accomplished by lime addition.

Under aerobic conditions not only is the optimum pH band wider, but there is not as much tendency for the pH value to decrease. In fact, there often is a tendency for the pH value of an acid waste to increase, and of an alkaline waste to decrease. As the material is oxidized, if the initial acidity in the waste is due to organic acids the pH value will increase and the CO_2 produced will affect the pH value (depending upon the bicarbonate, carbonate equilibrium). Wastes containing hydroxide alkalinity will tend to decrease in pH value by the interaction between CO_2 and the hydroxide-forming carbonates and bicarbonates. Production of nitric acid by nitrification tends to decrease the pH value in poorly buffered wastes.

The effects of temperature on microbial activities are well recognized and, therefore, do not need elaboration.

Treatment Process Selection

The choice between an aerobic or anaerobic waste treatment process will depend on a number of factors. The character and concentration of the waste is an important consideration in the selection of the process. Generally speaking, strong wastes containing considerable amounts of suspended solids are treated more economically by an anaerobic digestion process.

The required quality of the effluent to be discharged into the receiving stream is another determining factor. Normally, digestion processes do not produce an effluent as highly polished

and purified as do the aerobic processes. Although it is possible by increased capacity and detention to produce a 90 to 95 per cent reduction of pollutional materials by anaerobic processes, effluent quality requirements may not be met by anaerobic processes alone. A secondary aerobic treatment process following the digestion may be required.

It seldom is advisable to reverse the order of treatment and to treat the wastes by aerobic treatment first, followed by digestion. Little advantage is gained by settling wastes containing suspended solids, prior to digestion. It is simpler and more economical (as one step) to stabilize the settleable solids and the soluble and nonsettleable portions of the waste in the digester. Sedimentation and removal of settleable solids constitute a useful treatment process, either as the only method of treatment or in conjunction with secondary treatment processes. The first process is indicated for when the waste is weak or when the discharge of settled effluent into the stream constitutes sufficient treatment. The efficient removal of settleable solids in sedimentation tanks and "save-alls" performs a real function in preventing the formation of objectionable sludge deposits in the stream.

Sludge Solids Removal

The removal of settleable solids ahead of trickling filters prevents clogging of nozzles and of the filter stones. Thus, the capacity of the filter unit is utilized for the treatment of nonsettleable and soluble solids, for which it is primarily designed. In intermittent sand filtration it is also imperative to remove the settleable solids in order to prevent the clogging of fine-grained media. Activated sludge processes can operate without prior removal of settleable solids. Sludge collected by removal of settleable solids can be disposed of in a number of ways, digestion being that more commonly used.

Whether aerobic or anaerobic processes are used, contact between the waste and the organisms is one of the important factors in attaining efficient and maximum rates of stabilization. Proper contact may be achieved in a number of ways, as by mechanical agitation, air or gas mixing, or passage of the waste through or over the biologically active seed material.

In the digestion process, proper contact is achieved by mechanical stirring, pump circulation of the tank contents, forcing the collected gas through the tank, or passage of the waste through the seed sludge.

In the activated sludge process, either compressed air or mechanical agitation is used to bring the organisms in the floc into intimate contact with the waste. Contact in trickling filters is obtained by the distribution of the waste over the surface of the bed and the percolation of the waste over the slime surfaces coating the supporting medium.

Conclusion

In conclusion it should be stated that although an attempt has been made to present the factors of food, organisms and environmental conditions under separate headings as if they were separate entities, they are actually closely interrelated factors; a change in one of the factors changes the others. For instance, the population of organisms will change as a result of change in the nature of the food and environmental conditions.

This presentation has been of general nature and has not dealt with detailed specific cases. It is intended, however, to point out for further discussion areas wherein our knowledge is firm, and areas where further information is greatly needed if advances in the science and the art of stream pollution prevention are to be made.

Great opportunities exist for basic research. Well trained men with new ideas and tools are required for the successful solution of these problems. We cannot rework old ideas over and over again, nor can we expect to develop new and improved processes, better methods of control, and greater efficiencies by trial and error or by empirical methods without a better understanding of the mechanisms, organisms, and factors involved in the stabilization of polluted waters.

(The last of two articles)

W&SW

Francis X. Lambert Is Dead

Francis X. Lambert, Supt. of the Batavia, N. Y. sewage treatment plant for the past four and one-half years, died on October 24, 1954. Mr. Lambert was born in Batavia, N. Y., in 1916. He was a director of the Western Section of the N. Y. Sewage and Industrial Wastes Assn.

Mr. Lambert had been his father's assistant at the Batavia plant since 1936. His father had served the city for forty years. Mr. Lambert also succeeded his father as the city's official government weather observer. His many friends in the New York Association will long remember Mr. Lambert's loyal and conscientious service.

Treatise on Applied Hydraulics Published in Fourth Edition

A newly revised edition is available of "A Treatise on Applied Hydraulics" by Herbert Addison, printed in Great Britain and published in the U. S. by John Wiley & Sons, Inc., N. Y.

In his preface, the author points to uninterrupted progress in the art and sciences involved in hydraulic engineering. While he considers his "Treatise" a textbook of principles, it does serve as a guide to sources of more detailed information. The book is divided into two parts: fundamental principles and practical applications. It is clearly and comprehensively organized, thoroughly illustrated, and contains much related material of useful nature (examples, key to symbols, conversion factors, and a bibliography). The index of nine pages is especially complete and helpful; it refers to numbered paragraphs which comprise the text.

The first edition of this book was published just twenty years ago, and the present edition represents the author's lecture and laboratory experience over a period of thirty years. The fourth edition has 724 pages and is priced at $9.50.

Paul Farrell is Drowned

We have received a report of the death, by drowning, on January 8th, of R. P. Farrell, Director of the Dept. of Sanitary Engineering, Kentucky State Dept. of Health. Mr. Farrell served as Secretary of the Kentucky-Tennessee Section, AWWA, from 1943 to 1952.

He was Secretary of the Kentucky-Tenn. Industrial Wastes and Sewage Works Assn. since its inception.

REPORT FROM ABROAD

Problems of Atomic Energy Wastes and of "Too Much" Industry

by JOHN FINCH

Mr. Finch is Manager of the Sewage Disposal Dept., Rotherham, England. In his Report from Abroad, he discusses topics and opinions of timely interest. He will welcome the opportunity of replying personally to readers of Water & Sewage Works who require additional information regarding subjects covered in his series.

TWO very important and extremely interesting papers were presented during October, 1954, before a meeting of the Institution of Civil Engineers in Great Britain. "Design and Construction of the Handling and Treatment System for Liquid Radioactive Wastes" was the title of a paper given by W. L. Wilson, and "Operational Experiences with a Handling and Treatment System for Liquid Radioactive Wastes" was the title of that given by R. H. Burns.

These contributions to the technical literature relating to treatment of trade effluents, are, of course, amongst the first dealing with the impact of radioactivity on public health services and, in particular, with industrial effluent problems.

Radioactive Waste Treatment

They are particularly important because they contain a tremendous amount of detail, particularly from the design angle, not previously published in this field. They are interesting because they lift the curtain, as it were, on what to the very large majority of sewage treatment plant designers and operators, is a brand new treatment field, as yet, pretty well uncharted, unexplored, and withal, not without an element of danger.

The authors have detailed their difficulties both in the constructional and operational fields. While they have described what was done and how it was done, they have also given a considerable amount of information relating to things that were *not* done and the plant that was *not* used, along with reasons for the omissions. All these data, of course, are of the greatest possible value to other workers in this new field.

In 1945 the Ministry of Works was appointed as the construction agency for the Ministry of Supply for Atomic Energy Establishments in Great Britain. At that time, little knowledge regarding the treatment of radioactive effluents was available, although it was assumed that the normal standard services, effluent handling plant, and purification plant, etc., would be necessary.

However, in 1946 it became known that nuclear reactors would be built at Harwell, and that there would be the usual variety of radioactive laboratories of various types. The general difficulties included in the task of designing a suitable treatment plant were not made any easier by the fact that the treated effluent would have to be discharged into the River Thames.

A visit to the Canadian Atomic Energy establishment at Chalk River, made in the spring of 1946, helped to indicate the trends of the proposed treatment plant. It was possible to obtain there a certain amount of background data and fundamental design factors to establish a basis for design.

Segregation and Precipitation

Fundamentally, there were three possibilities that could be adopted for the proposed scheme. These were: a precipitation process (with or without filtration), distillation, and ion exchange. Distillation was considered to be uneconomic and impracticable, and ion exchange was believed to be a comparatively unknown process—as nothing was known of its virtues for the selective concentration of radioactive particles.

The wastes at Harwell were segregated into the four different categories of "very active," "probably active," "possibly active," and "inactive" materials. The system is such that each of the wastes is separately stored, controlled and checked; the first category of wastes being held in storage until it reaches a tolerable condition; the second and third categories being reduced to a level not harmful to animal life, whilst the fourth class is used as a diluent for the others.

The tolerances of maximum permissible levels of radioactivity in water have been prescribed by the British Medical Research Council, and are based on the assumption that everyone drinks 2.5 liters of water a day and lives for approximately 100 years. Since the River Thames constitutes the main source of drinking water for the London area, the greatest care had to be exercised to ensure these tolerances not being in any way exceeded.

In addition to the radioactivity standards prescribed, the various river authorities concerned specified the customary standards for the treated liquid discharged to the Thames. These standards were that the temperature of the liquid should not exceed 60 degrees Fahrenheit; that the B.O.D. (5-day) should not exceed 20 ppm; that the suspended solids should not exceed 30 ppm and that the pH of the liquid should lie between the limits 6.5 to 7.5.

Treatment Plant Details

With these data in hand, the necessary facilities at the proposed treatment plants could now be visualized. They comprised storage provided before and after treatment; sufficient storage before treatment to enable batching and averaging of the incoming liquid wastes, reagent mixing, controlling and discharging devices; precipitation tanks, and settling tanks. Also included were facilities for returning the liquid for re-treatment, if necessary; means of adding diluting water; duplication of necessary plant, and facilities for sampling the

wastes.

It is of interest to note that clariflocculators were installed to remove the precipitated solids which had adsorbed, during precipitation, the radioactivity from the liquid wastes. The settled sludge from the clariflocculators is discharged to a Sweetland filter press, where the ingoing slurry of 0.5 per cent solids is changed to a thickened sludge of 20-60 per cent solids, prior to disposal.

The clariflocculator has not operated with entire satisfaction. From time to time, difficulty has been experienced in preventing floc from passing over the weir of the tank. On occasion, it has been found necessary to dose the clariflocculators with additional quantities of weighting and coagulating agents to assist in the treatment, and facilities have since been provided for this eventuality. No provisions was made for such treatment in the original scheme.

Effluent and River Analyses

After clarification, the effluent is sampled, using sparge pipe samplers, or dip samplers, and the analysis is made. Analytical results determine whether the effluent is suitable for discharge, or whether it should be re-cycled prior to discharge. Effluents suitable for discharge are further sampled and the samples sent to two vitally concerned authorities: the Ministry of Housing and Local Government, and the Metropolitan Water Board, who are thus able to check the radioactivity level of the liquid going to the Thames.

The treated effluent, a volume of about 500,000 gallons, is discharged over a specially stepped weir into a channel of the Thames to which, by arrangement with the Thames Conservancy, is allocated about 50 mgd river water. Sparge pipes are located so that the discharged effluent enters into the region of maximum turbulence in the river water when it falls over the weir. In this way, both aeration and mixing of the effluent with the river water is achieved.

Periodic investigations of the river and the river mud around this area of discharge are carried out to ensure that no radioactivity builds up on the bottom or banks of the river.

It is rather interesting and significant to note that, during operation of the treatment plant, the performance of what is to all intents and purposes the final settling tank or clarifier has been no better than, or perhaps not so good as, its counterpart in the more conventional sewage treatment plant. Whereas in the conventional sewage treatment plant, effluents particularly low in suspended solids have been produced by the application of sand filters or microstrainers, such devices were considered to be quite impracticable in the case of the radioactive waste treatment plant.

Difficult Waste Problems

The volumes of trade effluent are far too great for the small streams and waterways into which they discharge . . . or to allow of their being introduced into public sewers.

Mersey River Board Report

The third Annual Report of the new Mersey River Board makes a bald statement of the almost incredible facts relating to this area. Thus, it forcibly reminds one of the devastating impact of sewage and trade effluent pollution upon the waterways of what is one of the most concentrated industrial areas in the world—South Lancashire—in a time when, due to severe financial stringencies in particular, there is an increasing backlog of pollution prevention schemes urgently required.

The picture which can easily be constructed, from a perusal of what is a very human report, is grim and forbidding. Moreover it is a picture which cannot easily or quickly be changed to something more attractive. Nevertheless, towards the conclusion of the report, a ray of sunshine appears which indicates that some progress is being made towards combatting the tremendous amount of pollution prevalent in the Board's area. It is not yet possible to show any material improvement in the condition of the chief rivers within the jurisdiction of the Board, the majority of them being in a very bad state.

River Water Classification Scheme

Dr. Klein, the Chief Pollution Officer to the Mersey River Board classifies samples of river water according to the findings of the Royal Commission on Sewage Disposal in their 1912 report, but subject to an extension of these findings designed to suit the local conditions of the Board's territory. The classification which is of particular interest not only to river authorities but also to sewage treatment and industrial works, is not often referred to, nor often seen published. It is cited in the table.

Table 1
River Water Classification

5-Day BOD of River Water	Classification
1 ppm or less	Very clean
2 ppm	Clean
3 ppm	Fairly clean
5 ppm	Doubtful
7.5 ppm	Poor
10 ppm	Bad
20 ppm	Very Bad

The classification assumes that the pollution is of an organic nature measured by the B.O.D. test. In certain circumstances the classification has been adjusted to allow for inclusions of, for example, large amounts of suspended solids, acidity or alkalinity, toxic substances, pollution by oil, and of high values in the oxygen-absorbed from acid permanganate test.

Pollution and More Pollution

Dr. Klein has one of the toughest problems ever to face a pollution prevention officer. Not only has he a major problem in the control of trade effluents, in this heavily industrialized area, but he also has a like problem with domestic sewage pollution in this equally heavily populated area.

Describing some of the waterways in the area under the Board's jurisdiction, he says of the Manchester Ship Canal that this water-way is thought of primarily in connection with navigation (which has made Manchester one of the leading ports in Great Britain), but that its use for the disposal of unwanted effluents is at least as important! He then goes on to say that the discharge of two sewage treatment plants between them contribute 67 mgd of somewhat unsatisfactory effluent to the Canal. Altogether 23 sewage treatment plants and 25 industrial plants discharge to the non-tidal portion of the Canal—which is only 13 miles long. In addition, the Canal receives all the pollu-

Radioactivity in Water

The tolerances of maximum permissable levels of radioactivity water . . . are based on the assumption that everyone drinks 2.5 liters of water a day and lives for approximately 100 years.

tion from the River Irwell, River Mersey and Glaze Brook.

The River Irwell with all its tributaries carries the effluents from 83 sewage treatment plants and 197 industrial plants, and in dry weather the main section of the river from Irwell Springs to Salsford Docks consists mainly of sewage effluents and trade discharges!

The Canal is described quite vividly as being a series of septic tanks, because the arrangement of weirs allows of no hydraulic gradient, and the suspended solids which settle out undergo putrefaction. The bad condition of the water is shown by analyses which indicate the presence of sulphides and the absence of dissolved oxygen.

Too Much Industrial Waste

One of the many difficulties existing in a highly industrialized area, such as that covered by the Mersey River Board, is that the size of the industrial concerns are such that the volumes of trade effluent are far too great for the comparatively small streams and waterways into which they discharge. Similarly the same volumes of trade effluent are invariably far too great to allow of their being introduced into public sewers for treatment at the sewage treatment plant. Under these exceptionally difficult and trying circumstances, it is therefore not always possible to make use of the appropriate Act of Parliament, which legislation is used to control the inclusion of trade effluents into the sewers.

Cases are on record in the current report of the Mersey River Board where volumes of trade effluent of the order of 400 per cent of the total sewage flow draining to the local treatment plant, have been suggested for inclusion into the public sewer for treatment—an impossible treatment situation. In such cases, the Mersey River Board could not possibly support an application made by the trader to put these huge volumes of trade effluent into the public sewer.

An example of the interest taken by an industrial firm to check up on sewage treatment difficulties is that of Imperial Chemical Industries Ltd. This firm has taken over a section of the Macclesfield sewage treatment plant for a full-scale investigation of the effects of the synthetic detergent "Lyssapol N" on the treatment of sewage.

The experiments will last about three years, and the firm has undertaken to determine by experiment if there will be any substantial change in the quality of the effluent from the sewage treatment plant. This work is undertaken both in the interests of the sewage treatment plant and of the detergent industry, with the full knowledge of the Mersey River Board. The results of this work are eagerly awaited and will be of the greatest value.

W&SW

Canada's Water & Sewage Groups Establish Joint Office in Toronto

The Canadian section of the American Water Works Association, and the Canadian Institute on Sewage and Sanitation have completed arrangements for the joint operation of an administrative office. This office is located at 72 Grenville Street, Toronto. The office, which was opened Jan. 1st, will be in charge of Mrs. Mae Grove, as Executive Assistant.

The work of these two organizations has been carried on for many years in the office of Dr. A. E. Berry, Director of the Sanitary Eng. Div. of the Ontario Dept. of Health. By joining the administrative procedures of both organizations into a single office it is feasible to provide sustained service with only moderate increase in dues.

This forward-looking move is the culmination of committee activities of both organizations. The by-laws and constitutions of both organizations have been amended to provide for this change.

Mrs. Grove, as Executive Assistant, is well known to the members of both associations. She has been active in the office work, and at conventions for a number of years, and is thoroughly familiar with the policies, activities and procedures of both groups.

Dr. Berry has agreed to continue as Secretary-Treasurer of both these long fortunate organizations.

Correction to "Rate Formulas for Industrial Wastes"

Mr. Ralph Porges of the Department of Health, Education, and Welfare, Public Health Service, USPHS, Kansas City, Mo., has pointed out an error in the article "Rate Formulas for Industrial Wastes," published in our December 1954 issue. Incorrect calculations were presented in Table 1 on page 541. Table 1 as corrected appears below.

Additional corrections should be made. On page 541 the line after Equation 4 should read: "where V_t = Vol. of Waste." On page 545, in the first column V should read: V_t.

TABLE 1

Comparison of Industrial Waste and Domestic Sewage

Industry	Unit of Production	Volume		5 Day B.O.D.		Suspended Solids	
		Gal. Unit	Pop. Eq.[1] Unit	Lb. Unit	Pop. Eq.[2] Unit	Lb. Unit	Pop. Eq.[3] Unit
Domestic Sewage	Per Capita Per Day	127	1.0	0.17	1.0	0.2	1.0
Oil Refining	100 bbl Crude Oil	77,000	606.	12.8	75.5	32.1	160.
Canning Tomatoes	100 Cases No. 2 Cans	750	5.9	25.0	147.	12.5	62.5
Wool Scouring	100 lbs of Goods	125	1.0	9.7	57.0	7.6	38.0
Paper Mill	1 Ton of Paper	39,000	307.	6.2	36.4	147.	73.5

1. Avg. per cap. flow = 127 gpd
2. Avg. per cap. B.O.D. = 0.17 lb per day
3. Avg. per cap. Susp. Sol. = 0.2 lb per day

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Technical Digests

Properties and Behaviors Of Cyanogenic Wastes

by C. E. Renn

Mr. Renn is Prof. of San. Eng., The Johns Hopkins Univ., Baltimore, Md. This is a brief digest of his paper presented at the 27th annual F. S. & I. W. A. meeting.

THE interaction of cyanogenic waste-bearing waters and their environment were studied in terms of waste disposal design requirements under the sponsorship of The American Cynamid Company. A variety of wastes were examined over a period of four years. First phases of the work in 1950 were directed toward discovering the tolerance limits of certain waste components by fresh water fish.

Young fresh water fish were found to react adversely to potassium cyanide concentrations exceeding 0.03 to 0.05 ppm N as CN^-. Lactonitrile yielded tolerance values only slightly less than potassium cyanide. Acrylonitrile was found less toxic to small fish than cyanide or lactonitrile, the tolerable range being 10 ppm acrylonitrile nitrogen.

In 1951 studies included seven species of young fish found in hard waters near the U. S. Fish and Wildlife Service Fish Hatchery Research station at Leetown, West Va. A total of 21 aquarium type experiments and 21 constant flow, constant concentration type experiments were made with these fish.

A sharp break in tolerance was exhibited by the continuously maintained cyanide concentrations of 0.05 ppm CN. Critical concentrations were slightly more than 0.09 ppm N as lactonitrile, when young fish were exposed to dilute solutions. Lactonitrile was demonstrated to have an acute toxicity appreciably below that of potassium cyanide.

Soil Column Studies

Tests performed with plant discharges and with lagoon effluents demonstrated that a considerable decline in overall toxicity was accomplished by holding wastes in lagoons. Favorable lagoon results were offset, however, by concern that sub-soil seepage might result in contamination of potable water supplies.

Soil columns were studied and striking results were obtained. In these studies the top soil surfaces of the columns were saturated with 100 ppm cyanide and potassium cyanide solution. A 90-ml volume of the solution was then metered through the columns each day. An immediate reduction, from a measured 98 ppm in the influent to 53 ppm in the effluent, was noted. After 20 days, an equilibrium value of 0.4 ppm was reached. Color of the soil extract was appreciable, increasing in density throughout the 20 days.

It was concluded that soil processes *other than bacterial fermentation* were significant in cyanide breakdown. Where immediate cyanide breakdown was observed, a further distinction was apparent when sandy-clay and humus soil were sterilized. In sandy-clay type soils, the rate of breakdown in sterile and non-sterile systems are roughly the same. Cyanide loss in contact with non-sterile humus-rich soils, on the other hand, is marked and more persistent.

One other soil phenomenon was observed which may have practical significance in designing for the disposal of cyanide-bearing wastes into deep soils. Soil columns were prepared for one-day flow-through, using cyanide concentrations of 100 ppm. This dosage will rapidly overload the system to the point of inefficiency; after 12 days a sandy-clay soil column passes nearly all the cyanide that is fed to it. This action is similar to break-through in overloaded zeolite columns.

A two-day rest permits a rise in cyanide assimilation when feed is resumed at initial rates. Therefore, loading limits for efficient performance do exist in connection with various soil types. Humus rich top-soil functions more satisfactorily in this connection than does sand or sandy clay.

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Petrochemicals Manufacture Process Wastes

by O. C. Thompson and G. F. Jenkins

Mr. Thompson is San. Engr., Veterans Adminis., Arlington, Va., and Mr. Jenkins is with the Eng. Dept., Carbide and Carbon Chemicals Co., South Charleston, West Va. This is a brief digest of their paper presented at the 27th annual F. S. & I. W. A. meeting.

WASTES from ethylene glycol manufacture have been investigated in pilot scale studies of biological means of treatment, including trickling filter and activiated sludge processes. Toxicity of wastes is determined by their action on biological organisms. Fly ash has been disposed of successfully through lagooning at several locations near Carbide and Carbon Chemicals Company plants. Land area has been reclaimed, and in one instance this practice has permitted expansion of a municipal recreation area.

W&SW

Packinghouse Waste Treated by The Anaerobic Contact Process

by Geo. J. Schroepfer, W. J. Fullen, A. S. Johnson, N. R. Ziemke, and J. J. Anderson

Mr. Schroepfer is Prof. of San. Eng., Univ. of Minnesota; Mr. Fullen is Chemist, Hormel & Co., Austin, Minn.; Messrs. Johnson and Ziemke are Instructors in Civil Eng., Univ. of Minnesota; and Mr. Anderson is Project Engr., American Meat Inst., Minneapolis. This is a brief digest of their paper presented at the 27th annual F. S. & I. W. A. meeting.

PILOT studies at the Geo. A. Hormel & Co. plant, Austin, Minn., were started in 1950 to provide data on the anaerobic treatment of 7,000 gallons of packinghouse wastes per day. Comparison of this process with conventional aerobic practices showed that further studies should be made to learn the effect of organic loading and detention period on the efficiency

of the anaerobic process. Additional studies on the removal of nutrients, deoxygenation constant of the effluent, the effect of nitrogen on long-time B.O.D. removals, heat requirements of the process, and other investigations were initiated in October 1952. For sludge separation and removal fly ash was used as a weighting additive.

Raw wastes from the Hormel plant are first screened. Grit and grease are then removed in a circular clarifier having a retention time of 19 minutes at a flow of 2.3 mgd. This preliminary treatment is followed by the pilot plant proper which consists of a square holding tank, a digester, and an evacuation tank.

Digester contents are constantly mixed and heated by pumping through an external heat exchanger. Gas is collected in the dome of the covered digester and is metered. The evacuation tank receives overflow liquor from the digester by means of vacuum conditions equivalent to 20 or more inches of mercury. The liquid cascades downward through the evacuation tank to a separation tank where final separation of solids is accomplished. Sludge solids are returned to the digester and the liquid effluent flows to a trickling filter.

The treatment process is capable of accomplishing 95 per cent removal of the 5-day B.O.D. and 90 per cent removal of suspended solids.

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Pickle Liquor Disposal by Oxidation and Lime Treatment

by Lorenz W. Heise and Milton Johnson

Mr. Heise is Director, Production Laboratory, and Mr. Johnson is Laboratory Supervisor, A. O. Smith Corp., Milwaukee, Wisconsin. This is a brief digest of their paper presented at the 27th annual F. S. & I. W. A. meeting.

SULPHURIC ACID is the most common agent used in the metal fabricating industry to remove mill scale or iron oxide from steel surfaces. The dilute acid reacts with iron, causing the release of hydrogen which loosens the scale. The scale may then be rinsed away or dissolved.

The acid solution eventually becomes saturated with iron salts, rendering it ineffective. Disposal of the waste acid constitutes a problem when nearby streams and sewerage systems are incapable of handling this pollution load.

The A. O. Smith Corp. in Milwaukee, Wisc., uses a concentration of 5 per cent sulphuric acid at 135° F for pickling. An increase in temperature (to 150° F) is used to compensate for weakening of the bath strength, until a low of 2 per cent acid strength is reached. The quantity of liquor to be disposed of at this plant exceeds five million gallons per year.

Thirty-six different disposal methods have been reviewed by this firm over a twenty-year period, resulting in the design of a waste treatment process using carbide lime—a waste by-product of the acetylene industry. The system involves slurrying the lime with constant agitation in a 3,000 gallon concrete tank. Compressed air is used to mix the lime slurry with the waste pickle liquor, maintaining 7.0-8.0 pH in the reaction mixture. Retention time is fifteen minutes, and 95 to 98 per cent chemical reaction efficiency is achieved.

Sludge removed in the process is dewatered on a disc-type rotary vacuum filter. Filter cake is disposed of at the rate of two-hundred tons per day. A portion of the filtrate is returned as make-up in the lime sump, the remainder being released to municipal sewers.

The agricultural utility of the neutral filter cake as a soil conditioner has been investigated with encouraging results.

W&SW

Treating Electroplating Wastes In Ion Exchange Units

by T. J. Fadgen

Mr. Fadgen is Chief Chemist and Metallurgist, Turnstedt Div., General Motors Corp., Trenton, N. J. This is a brief digest of his paper presented at the 27th annual F. S. & I. W. A. meeting.

WATER conservation and pollution prevention are basically identical problems. This is illustrated by the removal of chromium from plating rinse water by means of anion and cation exchangers. The liquid waste is deionized, and 97 per cent of the water received at the waste treatment plant is returned to the plating process. The end point for cation exchangers has been se' at 4.0 ppm as calcium carbonate, while the end point for anion exchange units is set at 4.0 ppm as sulfate. Regenerant levels have been determined by trial and error in an effort to operate as economically as possible.

Nickel, reclaimed as nickel sulfide, is converted by acidification to nickel sulfate. The sulfate solution is returned directly to plating baths, to make up water evaporation losses. Acid copper (acid-bearing copper sulfate) is added to acid baths as make-up instead of acid.

W&SW

Biological Treatment Applied To Industrial Wastes

by Roy F. Weston and W. W. Eckenfelder

Mr. Weston is San. Engr. in Charge of Waste Control, Atlantic Refining Co., Philadelphia, Pa., and Mr. Eckenfelder is a Partner, Weston, Eckenfelder and Hood, Inc., Ridgewood, N. J. This is a brief digest of their paper presented at the 27th annual F. S. & I. W. A. meeting.

THIS paper is a progress report which discusses theories applicable to oxidative waste treatment.

It is assumed that biological treatment follows the laws of stoichiometric and thermo-chemistry. If nitrogen is present, it will be oxidized to nitrate; sulfur will be oxidized to sulfate. Organic matter, measured as B.O.D., is removed from wastes as a part of cell growth, as a portion of the carbon from the waste becomes biological cells and the remainder provides energy to sustain life and to permit synthesis.

The material balance chemical equations and thermochemical laws show that a definite ratio exists between the amount of B.O.D. removed, the portion oxidized, and the portion synthesized, for any given set of conditions. The rate of reaction should be governed by the kinetics of cell growth and decay. It is assumed that the maximum rate of organic material removal occurs during the logarithmic growth phase.

Cell material concentration should be expressed in terms of volatile solids contained in the reaction solution. In practice, the solution would be the mixed liquor of activated sludge or the forward flow plus recycle of trickling filter operation.

The amount of B.O.D. remaining in the effluent per unit of activated sludge, for example, is equal to a constant times the applied loading per unit of sludge concentration. Departure from this relationship indicates that equilibrium has not been reached, or that there has been a change in the system. If equilibrium has not been reached, the B.O.D. removal efficiency will decrease as the applied loading increases.

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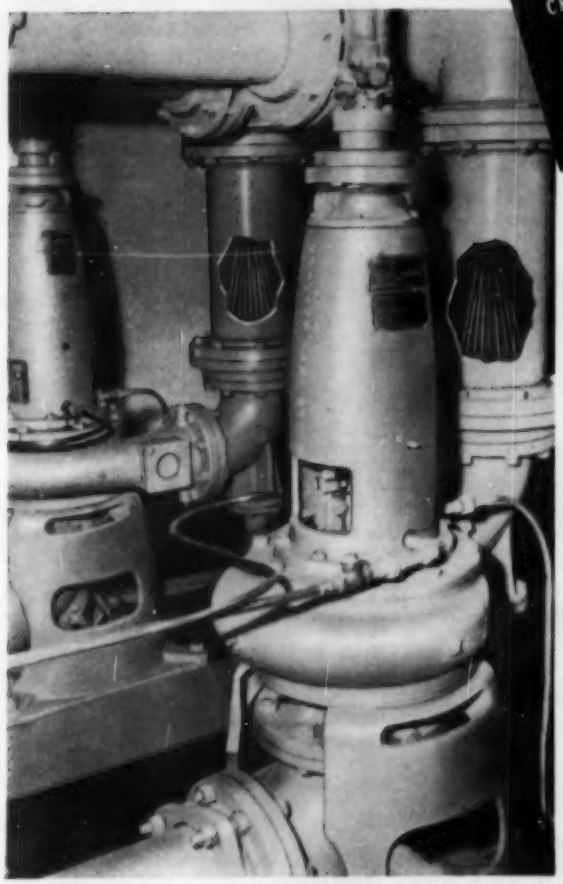

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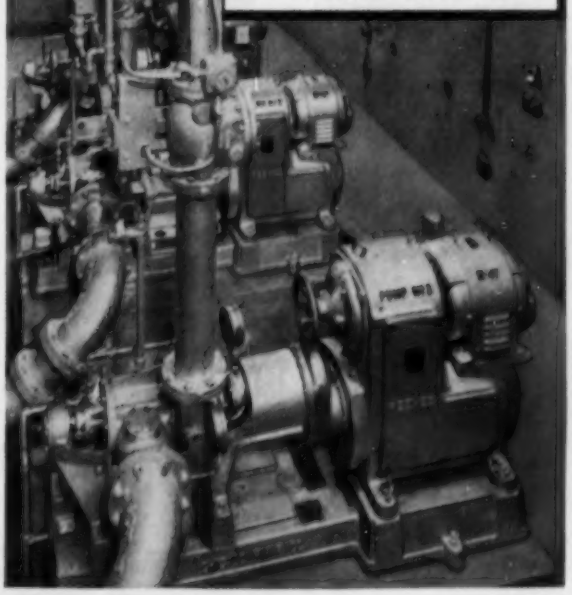

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Meetings Scheduled

Feb. 9-11—Indianapolis, Ind. *(Lincoln Hotel)*
INDIANA SECTION A.W.W.A. Sec'y, R. J. Becker, 1330 W. Michigan Street, Indianapolis, Ind.

Feb. 10-11—Ames, Ia.
AMERICAN PUBLIC WORKS ASSOCIATION *(Iowa Chapter)*. Sec'y Carl D. Smith, Cedar Rapids, Ia.

Feb. 17—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Feb. 17-18—Columbus, O. *(Ohio State Univ.)*
OHIO WATER CLINIC. (4th Annual Conference). Director, Kenneth W. Cosens, Ohio State Univ., Columbus, O.

Feb. 22-25—Sacramento, Calif.
CALIFORNIA MUNICIPAL UTILITIES ASSOCIATION CONFERENCE. Sec'y, F. V. Frey, Room 108, City Hall, Pasadena, Calif.

Mar. 6-11—College Station, Tex. *(Texas A & M)*
TEXAS WATER & SEWAGE WORKS ASSOCIATION. Sec'y, V. M. Ehler, 2202 Indian Trail, Austin, Tex.

Mar. 7-11—Chicago, Ill. *(Palmer House)*
NATIONAL ASSOCIATION OF CORROSION ENGINEERS. Sec'y, A. M. Campbell, 1061 M & M Bldg., 1 Main St., Houston, Tex.

Mar. 9-12—Boston, Mass. *(Sheraton Plaza Hotel)*
AMERICAN CONCRETE PIPE ASSOCIATION. Director, Howard F. Peckworth, 228 No. LaSalle St., Chicago, Ill.

Mar. 16-18—Baton Rouge, La. *(Louisiana State University)*
WATER & SEWAGE WORKS SHORT COURSE (18th Annual). Director, John H. O'Neill, Div. Public Health Eng., Dept. of Health, New Orleans, Pa.

Mar. 18—Trenton, N. J.
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSOCIATION. (1 day meeting). Sec'y, M. S. Kachorsky, P. O. Box 766, Manville, N. J.

Mar. 21-23—Savannah, Ga. *(DeSoto Hotel)*
SOUTHEASTERN SECTION A.W.W.A. Sec'y, N. M. de Jarnette, 245 State Office Bldg., Atlanta, Ga.

Mar. 31-Apr. 1—Durham, N. C. *(Duke University)*
FOURTH SOUTHERN MUNICIPAL & INDUSTRIAL WASTES CONFERENCE. Director, Prof. J. W. Williams, Head, Dept. Civil Engineering, Duke University, Durham, N. C.

Apr. 13—Bangor, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Apr. 13-15—Hutchinson, Kans. *(Baker Hotel)*
KANSAS SECTION A.W.W.A. Sec'y, H. W. Bradley, 119 West Cloud, Salina, Kans.

Apr. 13-15—Lincoln, Neb. *(Cornhusker Hotel)*
NEBRASKA SECTION A.W.W.A. Sec'y, E. Bruce Meier, Univ. of Nebraska, Lincoln, Neb.

Apr. 14-16—Chandler, Ariz. *(San Marcos Hotel)*
ARIZONA SECTION A.W.W.A. Sec'y, Q. M. Mees, Univ. of Arizona, 721 N. Olsen Ave., Tucson, Ariz.

Apr. 14-16—Chandler, Ariz. *(San Marcos Hotel)*
ARIZONA SEWAGE & WATER WORKS ASSOCIATION. Sec'y, Quentin M. Mees, 721 N. Olsen, Tucson, Ariz.

Apr. 18-20—Quebec, Can. *(Chateau Frontinac)*
CANADIAN SECTION A.W.W.A. Sec'y, Dr. A. E. Berry, Dept. of Health, Parliament Buildings, Toronto, Ont., Can.

Apr. 20-22—Buffalo, N. Y. *(Statler Hotel)*
NEW YORK SECTION A.W.W.A. Sec'y, Kimball Blanchard, 56 Grand Street, White Plains, N. Y.

Apr. 27-30—Riverside, Calif. *(Mission Inn)*
CALIFORNIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, J. C. Mallery, 4822 Dunsmore Ave., LaCrescenta, Calif.

Apr. 29-30—Butte, Mont. *(Finlen Hotel)*
MONTANA SECTION A.W.W.A. Sec'y, A. W. Clarkson, State Dept. of Health, Helena, Mont.

May 4-6—Pittsburgh, Pa. *(Hotel Webster Hall)*
PENNSYLVANIA SECTION A.W.W.A. Sec'y, L. S. Morgan, State Dept. of Health, Greensburg, Pa.

May 9-11—Lafayette, Ind. *(Purdue University)*
TENTH PURDUE INDUSTRIAL WASTE CONFERENCE. Director, Professor Don E. Bloodgood, Purdue University, W. Lafayette, Ind.

May 19-21—Yakima, Wash. *(Chinook Hotel)*
PACIFIC NORTHWEST SECTION A.W.W.A. Sec'y, F. D. Jones, Room 305, City Hall, Spokane, Wash.

May 25—Trenton, N. J. *(Tentative)*
NEW JERSEY SECTION A.W.W.A. (Summer Outing). Sec'y, C. B. Tygert, Box 178, Newark, N. J.

June 8—Bar Harbor, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

June 12-17—Chicago, Ill.
AMERICAN WATER WORKS ASSOCIATION. (75th Annual Convention). Exec.-Sec'y, Harry E. Jordan, 521 Fifth Avenue, New York 17, N. Y. (All reservations being cleared through A.W.W.A. office.)

June 13-14—Albany, N. Y. *(Hotel Ten Eyck)*
NEW YORK SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, R. C. Sweeney, 21 No. Broadway, White Plains, N. Y.
(joint meeting with)

June 13-14—Albany, N. Y. *(Hotel Ten Eyck)*
NEW ENGLAND SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Stephen M. Hurley, Jr., 331 State Office Bldg., Providence, R. I.

June 22-24—Columbus, O. *(Deshler-Hilton Hotel)*
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT CONFERENCE. Sec'y, Ward E. Conrad, 301 Ohio Departments Building, Columbus, O.

Aug. 15—Richmond, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Aug. 22-24—State College, Pa. *(College Dormitories)*
PENNSYLVANIA WATER WORKS OPERATORS ASSOCIATION. Sec'y, R. Rupert Kountz, Penn. State University, State College, Pa.
(joint meeting with)

Aug. 22-24—State College, Pa. *(College Dormitories)*
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, B. B. Bush, State Dept. of Health, Kirby Health Center, Wilkes Barre, Pa.

Sept. 7-9—Saranac, N. Y. *(Saranac Inn)*
NEW YORK SECTION A.W.W.A. Sec'y, Kimball Blanchard, 56 Grand St., White Plains, N. Y.

Sept. 7-9—Fort Dodge, Ia. *(Hotel Waukonsa)*
IOWA SEWAGE WORKS ASSOCIATION. Sec'y, L. F. Skorczeski, 207 South 15th Ave., Marshalltown, Ia.

Sept. 12-14—Lexington, Ky. *(Phoenix Hotel)*
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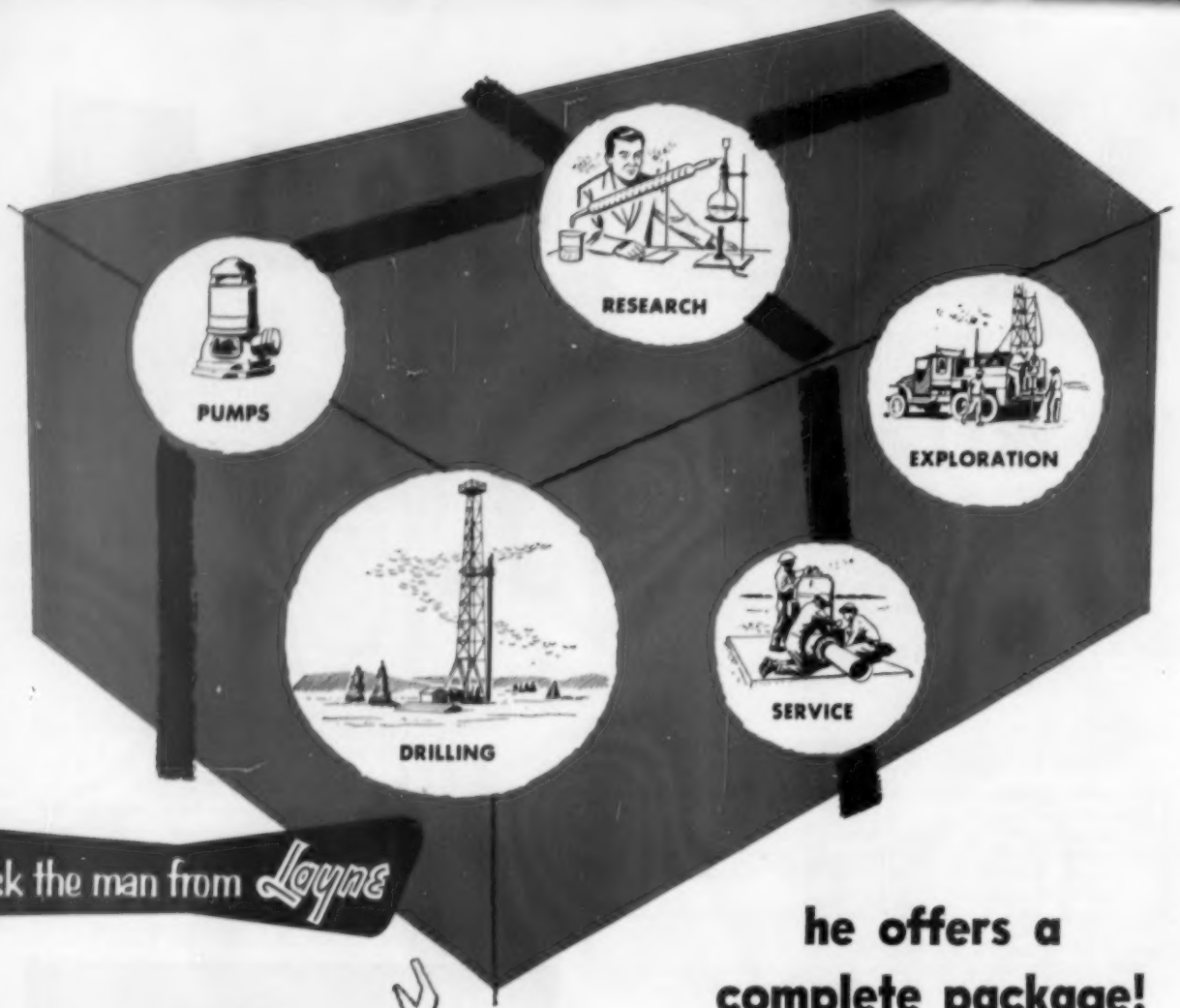

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KENTUCKY-TENNESSEE SECTION A.W.W.A. Sec'y, J. Wiley Finney, Jr., 553 S. Limestone St., Lexington, Ky.

Sept. 14-16—Flint, Mich. *(Durant Hotel)*
MICHIGAN SECTION A.W.W.A. Sec'y, T. L. Vander Velde, State Dept. of Health, Lansing, Mich.

Sept. 18-22—Lake Placid, N. Y. *(Lake Placid Club)*
NEW ENGLAND WATER WORKS ASSOCIATION. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Sept. 21-23—Columbus, O. *(Neil House)*
OHIO SECTION A.W.W.A. Sec'y, M. E. Druley, Dayton Power & Light Co., Wilmington, O.

Sept. 21-23—Milwaukee, Wis. *(Hotel Schroeder)*
WISCONSIN SECTION A.W.W.A. Sec'y, Leon A. Smith, City Hall, Madison, Wis.

Oct. 10-13—Atlantic City, N. J. *(Ambassador Hotel)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSOCIATION. (Annual Meeting). Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.

(joint meeting with)

Oct. 10-13—Atlantic City, N. J. *(Ambassador Hotel)*
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, M. S. Kachorsky, P. O. Box 766, Manville, N. J.

Oct. 12—Norridgewock, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr. 15 Bowdoin St., Winthrop, Me.

Oct. 16-19—San Antonio, Tex. *(Gunter Hotel)*
SOUTHWEST SECTION A.W.W.A. Sec'y, Leslie A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 19-21—Des Moines, Ia.
IOWA SECTION A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Ia.

Oct. 20-21—Clarksburg, W. Va. *(Waldo Hotel)*
WEST VIRGINIA SECTION A.W.W.A. Sec'y, Harry K. Gidley, State Dept. of Health, Charleston, W. Va.

Oct. 20-22—Atlantic City, N. J. *(Madison Hotel)*
NEW JERSEY SECTION A.W.W.A. (Fall Meeting). Sec'y, C. B. Tygert, Box 178, Newark, N. J.

Oct. 24-28—New York, N. Y. *(Hotel Statler)*
AMERICAN SOCIETY OF CIVIL ENGINEERS. (Annual Meeting). Sec'y, Wm. N. Carey, 33 West 39th St., New York, N. Y.

Oct. 25-28—Sacramento, Calif. *(Senator Hotel)*
CALIFORNIA SECTION A.W.W.A. Sec'y, Henry F. Jerauld, 1040 Manzanita, Pasadena, Calif.

Oct. 26-28—Washington, D. C. *(Hotel to be announced)*
CHESAPEAKE SECTION A.W.W.A. Sec'y, Carl J. Lauter, 6955—33rd St., Washington, D. C.

Oct. 30-Nov. 2—Biloxi, Miss. *(Buena Vista Hotel)*
ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, Charles W. White, 537 Dexter Ave., Montgomery, Ala.

Nov. 3-5—Richmond, Va. *(Jefferson Hotel)*
VIRGINIA SECTION A.W.W.A. Sec'y, J. P. Kavanagh, 213 Carlton Terrace Bldg., Roanoke, Va.

Nov. 6-9—Orlando, Fla. *(Hotel to be announced)*
FLORIDA SECTION A.W.W.A. Sec'y, Harvey T. Skaggs, P.O. Box 2328, Jacksonville, Fla.

Nov. 14-16 *(Place not selected)*
NORTH CAROLINA SECTION A.W.W.A. Sec'y, Wilber E. Long, Jr., 1615 Bickett Blvd., Raleigh, N. C.

Nov. 14-18—Kansas City, Mo. *(Municipal Auditorium)*
AMERICAN PUBLIC HEALTH ASSOCIATION (83rd Annual Meeting). Exec.-Sec'y, Dr. Reginald M. Atwater, 1790 Broadway, New York, N. Y.

Dec. 14—Augusta, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

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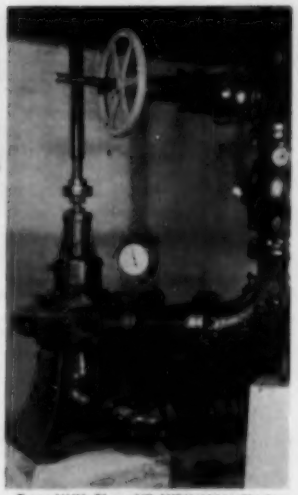

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New Equipment

Low-Cost pH Meter

201

Photovolt Corporation, New York, N. Y., has announced a new Model 115 pH meter.

Speedy, direct readings are possible on the new meter as there are no dials to turn, no button to hold and the concise step-by-step operating instructions are engraved on the panel.

The meter is a one-stage amplifier, cathode-follower type, comprising two miniature tubes in balanced circuit, hermetically sealed for freedom from humidity effects, contained in easily exchangeable plug-in unit.

According to the company, the price is not much higher than better-grade color comparison sets and is just as easy to use.

Water and Coolant System Filters

202

Cuno Engineering Corp., Meriden, Conn., has announced that new designs on the smaller units of the Cuno Flo-Klean filters have increased service life and improved performance. The new design is a top feed, balanced backwash nozzle which has had an accumulated field operating experience of about two years. According to engineers of the Company, the new design of the backwash nozzle with hydraulically balanced discharge reduces bearing and motor loads, resulting in longer service life. Adjustable shoes on the new nozzle improve performance while removing a wide variety and size of foreign matter from large volumes of liquids.

This type of filter is being used by plants to permit direct intake of raw water from such sources as lakes, rivers and wells. The newly designed Flo-Klean has a capacity up to 1275 GPM and a range of degree of filtration from .0025" to .030" (230 to 25 mesh). Other designs are available with capacities to 15,000 GPM with the same degree of filtration.

Telemetering For Water and Sewage Plants

203

Automatic Control Company, St. Paul, Minnesota, has developed a new and simple telemetering system wherein two wires do the work of sixty. This telemetering system is the first one designed exclusively for the automatic remote control of municipal and industrial water and sewage equipment. It is called Autocon "Telestep".

It provides transmission for up to thirty control or continuous proportional signals in either direction between a transmitter and one or more receivers to span distances between outlying deep wells, reservoirs, treatment basins, elevated storage facilities and central control centers.

Telestep control is effected using Automatic Control Company custom systems which provide float, pressure, bubbler or probe sensing devices, together with alarms and other protective equipment. It uses DC signals to reduce and eliminate inductive and capacitive effects in transmission lines. Autocon Telestep can be used with #26 wire or larger. Leased telephone wires or private cables are normally used.

Outstanding features of the system are: it is simple—and employs only very elementary electrical principles easily understood by plant personnel; it is easy to maintain because it uses only basic components and circuits; it provides multiple continuous proportional signal transmission in addition to multiple control signal transmission.

Pipeline Ditcher

204

Gar Wood Industries, Inc., Findlay Division, Wayne, Mich., has announced a new pipeline and utility ditcher, the Buckeye model 315.

The Buckeye 315 is a heavy-duty, wheel-type ditcher designed for digging ditches for cross-country pipelines for oil and gas, as well as storm sewers, main sewerage lines and systems, water mains, electric and telephone cables and conduit, and building foundations and footings.

It is designed to dig to a maximum depth of 6' with widths of cut varying from 24" to 40" in steps of 2". The machine has 8 digging speeds forward, from 1.37 to 20.49 feet a minute. Independent wheel and crawler speeds make the machine exceptionally flexible, since maximum or minimum speed of either is available with maximum or minimum speed of the other.

New Valve Eliminates Causes of Valve Failure

205

The Richmond Foundry and Manufacturing Co., Richmond, Virginia, is now producing a new and improved version of the Ostlind Valve.

Re-Christened the "Gyroseal" valve, they eliminate the causes of valve failure by causing the disc to rotate rapidly at the moment of closure. Foreign particles are thrown off by centrifugal force and the turbulence created keeps the particles in suspension while the disc is gently polished against the seat.

Far stronger yet simpler in construction than the original valves having this feature, "Gyroseal" valves are said to last longer, need less repair and are simple to repack.

New Flow Meter For Sanitary Engineers

206

Minneapolis-Honeywell, Industrial Division, Philadelphia, Pa., has announced that a float-actuated flow meter made by the company has been redesigned to meet measurement and control needs of sanitary engineers.

By proper selection of cams and floats the meter can be used to measure flow rates through weirs, Parshall flumes and other open channels. The meter combines recording, indicating, and totalizing functions in a single instrument and is capable of holding its calibration indefinitely. It may include pneumatic control and transmission.

Applications for the redesigned model range from flow measurements in sewage and water plants to measurement of sand expansion during backwashing in water filtration plants.

New Packaging For Lab Filter Papers

207

Eaton-Dikeman Company, Filtertown, Mt. Holly Springs, Pa., has developed new packaging for their laboratory filter papers.

The new package design permits the container to hold 200 discs, instead of the traditional 100. The package has a high identification value, is dust and moisture proof and has reduced the price of the filter papers.

The Lab-Pak 200 is being offered in diameters of from 7.5 to 25.0 cm., and in six different grades. More than 60 grades are regularly stocked, and both regular and special filter papers are available in every size and shape.

New B.O.D. Incubator

208

Fisher Scientific Company, Pittsburgh, Pa., has announced the production of a new large incubator that places temperatures from 5° to 50°C, held to within 1°.

The incubator is an 8.3 cu. ft. size, and holds up to 160 standard-size 300-ml B.O.D. bottles. It maintains the 20°C temperature specified by the American Public Health Association for measurement of biochemical oxygen demand even though the laboratory temperature soars to a mid-summer 100°F or drops toward freezing in winter.

Below room temperature, the refrigerator cools the cabinet to the required temperature and a heating-circulating unit acts as a regulator. Above room temperature, the thermostated heater maintains the desired temperature.

Cultures may be inactivated in the refrigeration compartment at the same time that B.O.D. bottles are incubated at 20°C in the cabinet. And the floor of the cabinet is available for storage at all times.

Catch Basin Cleaning Attachment

209

Pippin Construction Equipment, Inc., White River Junction, Vermont, has developed a Catch Basin Attachment for the Pippen Excavator. The attachment was developed to fill a need for a fast, inexpensive method of cleaning catch basins which will not tie up a large investment in single purpose equipment.

This attachment mounts on a standard Pippen Excavator. Maximum efficiency is achieved through complete hydraulic control. With the dipper stick of the Excavator fastened in position, it's hydraulic cylinder is used to operate the cable and sheave mechanism which lowers the orange peel bucket to a maximum depth of 19½ feet below the ground level. The bucket, opened and closed by a double acting cylinder, is easily filled and raised to 9 feet above ground for loading directly into a truck.

New Labeling and Packaging for Plastic Pipe

210

The Yardley Plastics Co., Columbus, Ohio has announced the new "Pressurated" plastic pipe is now available in the new dispenser carton.

The new piping is made with pressure ratings of 75-, 100-, 125-lb. in sizes ½ through 2 inches. The specified working pressure is the same in all sizes. Each is guaranteed to withstand the working pressure at which it is rated and the pressurating is stamped on every length of pipe.

The new cardboard dispensing carton improves both stocking and handling. It contains 100-ft. coils of 75-lb. Pressurated pipe in ½, ¾, 1, and 1¼ inch sizes. All cartons are labeled as to size and pressure rating and a heavily imprinted circle can be cut out of the reverse side of package for easy dispensing.

Automatic Pump Control For Sewage Plants

211

Automatic Control Co., St. Paul, Minn., has developed a system of accurate automatic controls for the use with multi-speed pumps in sewage treatment.

The system includes primarily an extremely sensitive sensing diaphragm 4" in diameter, with free-floating contacts which feeds pressure change information into a continuous balance amplifier. Less than ⅛ inch change in water level is sufficient for this special Bubbltrol system to sense and send signals calling for appropriate action.

A bubbler tube in an intermediate tank senses fluid level changes and activates a series of pumps in needed sequence to keep the fluid level uniform. According to the company, this system, gives unsually high economy in the operation of pumps as a result of its sensitivity because no more pumps are in operation at any one time than are absolutely necessary.

New Wrist-Action Dipper for Hydrohoe

212

Bucyrus-Erie Co., South Milwaukee, Wis., has developed a new Hydrohoe attachment with wrist action to increase the utility and speed of the H-3 Hydrohoe—its all-hydraulic dragshovel.

The new Hydrohoe retains the basic advantages of the standard model but introduces a new additional digging force through a dipper that rotates in a vertical plane through an arc of 65 degrees from a position of 25 degrees ahead of the handle to 40 degrees behind it.

The new dipper not only provides increased digging force, but also lessens spillage and improves ranges for clean dumping into trucks. It can dig vertical or undercut walls and trenches actually deeper than they are long. In addition, the operator can change the pitch or rake of the dipper teeth during the digging arc for the best cutting angle and can pry out rocks or expose pipe with less danger of pipe damage.

When the dipper is rotated simultaneously while the digging ram is extended, the combined effort produces about 38 hp at the dipper teeth and a 50% increase in digging power (up to six tons of tooth force) may be obtained. The hydraulic ram controlling the wrist action is powered by the pump which normally supplies the swing bank.

Air Supply Filter For Pneumatic Instruments

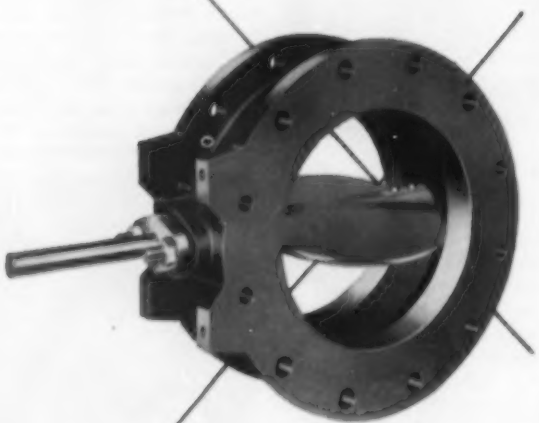
213

The Foxboro Company, Foxboro, Mass., has developed a compact air filter, designed to prevent dirt, oil,

(Continued on page 95A)

Blue Chip

For water works service...specify AWWA standard butterfly valves...



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Oklahoma City Water Dept. tests its Le Roi L3460 Engines

...proves their economy in municipal service!

THESE figures show you the kind of economy many municipalities enjoy by using Le Roi power:

On a 221-hour test run in Oklahoma City, two standby pumps powered by Le Roi L3460's...

...pumped an average of 7677 GPM each

...used only 990 cubic feet of gas per million gallons

...used only .43 gallon lube oil per million gallons pumped.

Engine operating costs were about one-half of the 760 KWH per million gallons required to pump by electricity. That's the kind of performance that saves money for taxpayers!

One of the underlying reasons for the economy and dependability of Le Roi engines is the fact that they are built by a manufacturer who concentrates exclusively on heavy-duty engine design.

Give *your* community the advantages of Le Roi power. Le Roi engines are available in sizes ranging from 20 to 600 hp — custom generator sets in sizes from 50 to 300 KW. They operate on no-cost sewage gas, natural gas, butane, or gasoline.

E-64

Write today for detailed information

LE ROI

LE ROI Division of Westinghouse Air Brake Co.
Milwaukee 14, Wisconsin

PORTABLE AIR COMPRESSORS • TRACTAIR • STATIONARY AIR COMPRESSORS • ENGINES • AIR TOOLS • TRUCK MIXERS • FRONT-END LOADERS

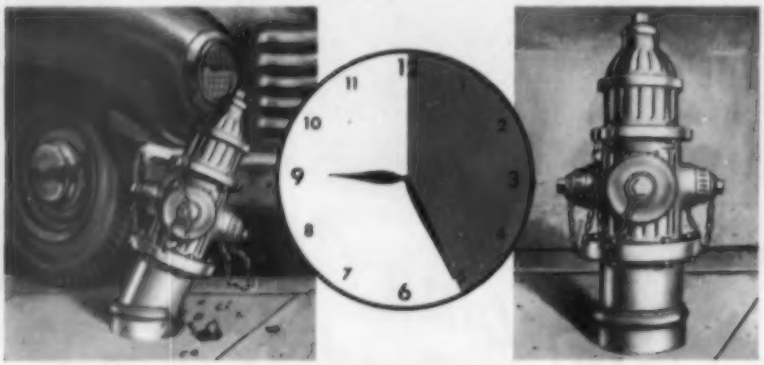
(Continued from page 95A)

water and other foreign matter from entering pneumatic instruments.

The new filter consists of four major elements: a top cap with supply and outlet connections; a chamber with a drain cock at the bottom; a resin impregnated filtering sleeve; and a water baffle. The unit measures approximately 8½" by 4⅛" and can be mounted in a supported line or bolted to a wall or panel.

Supply air enters through the inlet port, strikes a baffle plate on the cap, enters the chamber, passes through the filter and leaves through the outlet port. Moisture drops to the bottom of the chamber and is easily drained off or blown out through the drain cock. The filter sleeve, of moisture-resistant cellulose, removes particles as small as 40 microns. It is inexpensive and can be easily cleaned or replaced.

Filter capacity is 4 cfm of air or natural gas; sump capacity is 12 cubic inches; filtering area, 21.2 square inches; and maximum working pressure, 150 psi. Supply and outlet connections are ¼" NPSF.



Replaced in less than half an hour

WITHOUT EXCAVATING

The Mathews Modernized Hydrant is the leader in its field because it is simple in design and quickly accessible for repair or replacement. Here are some of the outstanding features of the Mathews Modernized Hydrant.

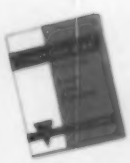
The Replaceable Barrel. Contains all working parts and can be replaced with another in jig time *without excavating.* When the hydrant is broken in a traffic accident, fire protection is interrupted for less than 30 minutes!

Compression-Type Main Valve. The Mathews Hydrant uses water pressure to help tighten the valve. No leaks, even when the hydrant is bowled over by a truck.

Stuffing Box Plate. Cast integral with the nozzle section, eliminates an extra part and a flange joint. A stronger, safer, leakproof construction.

Operating Thread. The stuffing box plate prevents water and sediment from reaching the operating thread. No rust can form. No ice can jam it in cold weather.

And all these other quality features: Head turns 360° simply by loosening bolts • Replaceable head • Nozzle sections easily changed • Nozzle level can be changed without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • A modern barrel makes an old Mathews good as new • Mathematical joint pipe connections optional.



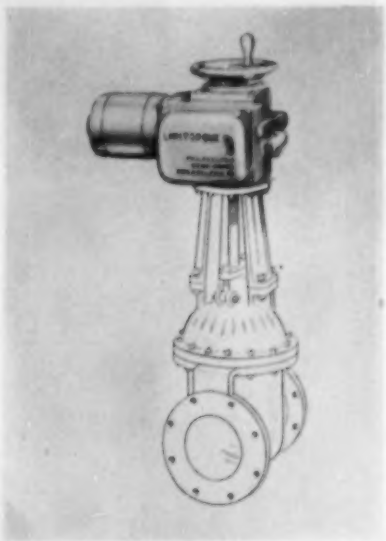
Send for this 80-page catalog. It contains full information about the R. D. Wood line of Cast Iron Pipe, Fire Hydrants, Gate Valves, and Hydraulic Machinery.

MATHEWS HYDRANTS

Made by R. D. Wood Company

Public Ledger Building, Independence Square
Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves



LimiTorque Valve Controls

214

Philadelphia Gear Works, Philadelphia, Pa., has developed the new SMA-00 and SMA-000 LimiTorque Valve Controls that answer the long felt need for a motorized valve operator for small valves ranging from 1½" to 8" part diameters. These new Motorized Valve Operators may be controlled electrically from any conveniently located pushbutton station. In case of power failure, a handwheel is incorporated in the control unit for manual operation if necessary. Size for size these new LimiTorque Controls furnish more stem torque, and have greater capacity than any valve control now in service.

As the name implies, "LimiTorque" limits the amount of torque applied to valve operating parts. Also the amount of torque or stem thrust may be accurately adjusted for varying service conditions through a micrometer type "torque switch."

These new LimiTorque Controls offer a new and more economical method of motorizing gate, plug, and butterfly valves.

Standardized Belt Conveyors For "Short Haul" Needs

215

Barber-Greene Company, Aurora, Illinois, has announced a new standardized, belt conveyor for "short haul" requirements. Units of the new series are called "Transfer Conveyors."

Heretofore, conveyors under 40 feet in length have either been made up from components designed for higher horsepowers than needed, or have had to be specially designed.

To solve this problem, Barber-Greene has designed standardized

components for the short conveyor range. These components may be assembled to form conveyors ranging from 8 to 44 feet in length, in increments of 1 foot.

Mounted on a 5 inch channel frame, the "Transfer Conveyor" is available in 18, 24 and 30 inch belt widths and in lengths as already specified. Units up to 20 feet in length are shipped, completely factory assembled, except for carriers and belt.

Being of channel frame construction, the "Transfer Conveyor" can be used in underground installations or elsewhere where headroom is limited. At the same time, its construction is sturdy and the conveyor can span up to 15 feet between supports.

Heavy Duty Line Construction And Maintenance Body

216

Morysville Body Works, Boyertown, Pa., has announced the addition to their line of a new Heavy Duty Municipality Body for water and gas line construction and maintenance work. Designed for chassis rated 2 to 2½ tons, this new service body has an overall length of 13½ feet, with a CA dimension of 108", and a 4-man crew compartment.

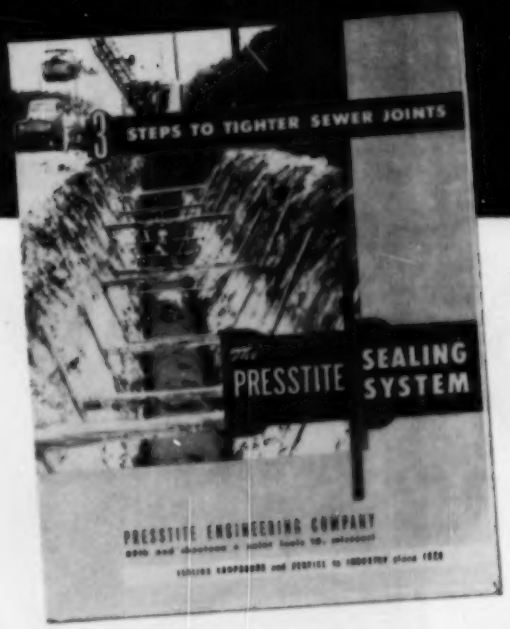
Interior features include deep lipped stowage shelves running across the front and along each side of the main compartment; choice of double drum winch or air compressor; rear door with window; and, forward, a 4-man crew compartment with two porthole type windows.

Exterior features include: two section sliding roof; ladder hooks; hand grips; rear step; towing hook; threading machine; derrick poles; and derrick pole mounting brackets. In addition, there are sixteen, weathertight exterior compartments, each fitted with individual tumbler type locks.

For safety, all compartment doors have recessed, spring loaded latches. Those doors with vertical hinges are hinged at front, so that if not properly latched, they will not blow open when the truck is moving. Compartment doors opening from the top (horizontal hinges) do *not* have stopper chains,—thus, the truck cannot be driven off with these doors hanging straight out, a law in some states.

let this free book show you . . .

HOW to get tighter sewer joints



You can meet the lowest infiltration requirements. This free book gives you the answers!

WHAT Presstite's famous 3-step sewer joint sealing system is.

HOW to apply these materials in three fast, simple steps.

WHERE Presstite's sewer joint sealing system has already proved successful under all types of conditions.

WHY the Presstite system is superior to other materials for securing extra-tight, dependable sewer joints.

20 pages full of photos, figures, laboratory data and specifications that will give you a proven system for tighter sewer joints.

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Please send me my free copy of the new Presstite book *3 Steps to Tighter Sewer Joints.*

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• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

Variable Capacity-Variable Head Pump

217

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has developed a new variable capacity-variable head centrifugal pump (Type ACAP) for use in handling any consistence from water up to 5 per cent paper pulp under varying capacity and head conditions.

The new pump consists of an internal by-pass bolted directly to a remachined single-suction centrifugal pump. The power requirement is almost constant over the entire range of operation.

The new unit resembles a standard single suction pump with an extension bolted in place. Circular motion on the operating mechanism is used to change the clearance between a revolving impeller and a stationary wear plate cylinder, thereby controlling the flow from the discharge nozzle of the pump by by-passing fluid within the pump.

Design of the new pumps gives a capacity range of 0 to full rating, and on pumps up to 35,000 gpm and heads from 15 to 100 feet with other variations possible.

Here is another example of the growing, world-wide acceptance of the Centriline Process! In Manchester, England, a total of over 23,000 feet of 48", 90" and 99" *new* steel pipe is currently under contract to be centrifugally lined with cement mortar. Centriline in conjunction with John Mowlem & Co., Ltd., London, is handling the entire project for the Manchester Corporation Water Works.

On this project, brand new steel pipe is being Centrilined to guarantee indefinite pipe life. But Centriline is just as effective on old pipe . . . tuberculation and corrosion are eliminated forever . . . small holes are sealed . . . flow capacity is increased, pumping costs lowered . . . and the pipe is given a complete new lease on life. Follow the lead of water works officials around the world by turning to Centriline for the solution to *your* pipe problems.

3,500,000 FEET OF EXPERIENCE

CENTRILINE CORPORATION

A subsidiary of Raymond Concrete Pile Co.

140 CEDAR STREET • NEW YORK 6, N.Y.

Branch Offices in Principal Cities of the United States and Abroad

CEMENT-MORTAR LINING OF PIPES IN PLACE

World's Largest Ditcher

218

Gar Wood Industries, Wayne, Mich., is designing the largest ditching machine in the world, capable of digging a ditch 15 feet wide and 30 feet deep.

The new giant digger, Gar Wood Buckeye Model 435, will be used to excavate intercepting and outfall sewer trenches, water diversion aqueducts and other large ditches. It will sell for about $100,000, approximately 50% less than the cost of conventional excavating equipment now used for this ditching work.

Overall approximate dimensions of the new ditcher are: Length, 81 feet; height, 15 feet; width, 12 feet, excluding the dirt discharge conveyor. Its estimated weight will be 65 tons. The big ditcher will be built at Gar Wood's plant in Findlay, Ohio.

The machine will be crawler mounted at the digging end and supported by rubber tired wheels in front. Two diesel engines with torque converters will supply power to the crawlers and the digging drive. Hydraulic power steering will be another feature.

Combination Colorimeter-Spectrophotometer

219

Bausch & Lomb Optical Co., Rochester, N. Y., has announced a combination colorimeter and spectrophotometer which produces high wavelength accuracy and spectral purity through use of a diffraction grating.

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Called the Spectronic 20 because of its 20mmu band pass, the instrument is designed for speedy, simple operation for laboratory technicians who need use only two control knobs in making routine colorimetric analyses.

It also offers flexibility and a high degree of accuracy to research and quality control people concerned with the more complex analyses of spectrophotometry, the company said.

The Spectronic 20 analyzes any liquids or solids which transmit light by subjecting a sample to light of specified wavelengths. The degree of light transmittance is registered on a double scale, where readings may be taken in terms of either transmittance or optical density.

The operator can adjust the diffraction grating for any wavelength in the entire range of the instrument by turning a control knob, without being limited to available filters.

Water Hammer Shock Absorber

220

Josam Manufacturing Co., Michigan City, Ind., has developed a new Shock Absorber that promises to end the annoying problem of water hammer in pipe lines.

The new Josam Shock Absorber has a specially milled Flex-lastic insert and the compression molded tube in the steel shell of the Shock Absorber, the thrust and impact of the water entering the tube expands it against the insert until the energy caused by the pressure is dissipated. As the shock recedes, the Flex-lastic tube and insert regain their original form, ready to receive the next shock impulse.

The Flex-lastic tube and insert never reach their elastic limit regardless of the shock to which it is subjected. Under accelerated and fatigue tests equal to several lifetimes of use the new Shock Absorbers have withstood maximum distortion, maximum aging and tensile strength, whereas, in the relief devices now in use, the expansion to dissipate the shock must operate within the physical limits of the metal or fabricated joint without distortion beyond the possible recoil to its original shape.

Manhole Vault Heater

221

Perfection Stove Company, Cleveland, Ohio, has available a compact, portable heater for heating manhole vaults during cold weather work.

The unit, Model 600, produces 60,000 Btu's of heat per hour and weighs only 114 pounds including the fuel for five hours service. It burns fuel oil or gasoline at temperatures as low as minus 70° F.

No. 3* of . . .

12 REASONS WHY
YOU SHOULD BUY AND USE
LOW-PRICED

HOMESTEAD
Lubricated
PLUG VALVES
Pat. Pending

Insist on 100% pipe area **HOMESTEAD LUBRICATED PLUG VALVES** to avoid costly pressure losses. If a slight restriction is unimportant, worthwhile savings can be made by using our Venturi type valve.

Your choice of ports is only **ONE REASON WHY** you should buy and use, *low priced* **HOMESTEAD LUBRICATED PLUG VALVES.**

HERE ARE ALL TWELVE

1. Reinforced Teflon packing ring.
2. Completely controlled high-pressure lubricant system.
3. 100% pipe area and venturi patterns.
4. No spring torsional stress.
5. No mechanical adjustments.
6. Two lubricants handle most services.
7. Extremely close tolerance between seating surfaces.
8. Triple head-seal with Lubricant and Teflon packing ring.
9. Plug floated on Teflon surfaces.
10. Leak-proof, double-ball-and-lubricant-sealed check valve.
11. Full-threaded screw assures clean lubricant.
12. Extruded lubricant shows a full protecting system.

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Without obligation, send Reference Book 39—Section 5 on HOMESTEAD LUBRICATED PLUG VALVES.

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HOMESTEAD VALVE MANUFACTURING COMPANY
Serving Since 1892

P. O. BOX 42 CORAOPOLIS, PA.

Get full details of this month's products . . . mail your Readers' Service card today.

W&SW

Manufacturers' News

Cochran Elected President of Chapman Valve

The Chapman Valve Manufacturing Company, Indian Orchard, Mass., has announced that Ernest Cochran, formerly Executive Vice President, has been elected to the office of President and General Manager of the Company, succeeding John J. Duggan, recently deceased.

Mr. Cochran has been connected with the Chapman Company since 1916, and has served in many capacities including Manager of Sales and Engineering, Vice President, and since February, 1954, Executive Vice President. He has served on the Board of Directors since 1943.

MH
MECHANICAL JOINT
Cutting-in SLEEVE
Easy, Quick, Economical
Valve Set in Line
Joint Completed
This M & H mechanical joint Cutting-In Sleeve makes it easy to install a mechanical joint or a hub end gate valve or pipe fitting into an existing pipe line. Out of the pipe line cut only a length of pipe equal to the over-all length of the valve or fitting to be installed, plus 9 inches. The mechanical joint Cutting-In Sleeve is then telescoped over one of the cut ends, the valve inserted into position and the Sleeve pushed back to socket into the valve bell. The joint is then bolted up if it is mechanical joint valve, or poured and calked if hub end valve. For complete information, write or wire M & H Valve and Fittings Company, Anniston, Alabama.
M&H PRODUCTS
FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

A. S. Blank Joins Modern Swimming Pool Co.

Modern Swimming Pool Co., Inc., White Plains, N. Y., has announced the appointment of Arthur S. Blank, formerly Chief Chemist of the Connecticut State Department of Health, as head of its water analysis and bacteriology department.

Mr. Blank has been active in water and sanitation chemistry for over 17 years. His broad experience covers the chemistry of swimming pool and drinking water, lake and river water, and problems of sanitation.

As Chief Chemist for Modern Swimming Pool Company, Mr. Blank will work with the Staff of Modern's Free Advisory Service which serves as a source of information and guidance for owners and operators of swimming pools and water supply departments. He will serve as consultant on problems relating to water chemistry, bacteriology and sanitation and on the development of improved methods of chemical treatment of pools, lakes and reservoirs.

Pitkin Gen. Sales Manager For Oliver Filters

Oliver United Filters Inc., Oakland, California, has announced the appointment of Ward H. Pitkin as General Sales Manager.

Mr. Pitkin will maintain his headquarters at the company's home offices at Oakland, California. A graduate of the University of Michigan, he first became associated with Oliver United in 1925, and since then has been connected in various capacities in research, as head of the pulp and paper division, and most recently as Assistant General Sales Manager.

Carborundum Expands and Reorganizes Pacific Operations

The Carborundum Company, Niagara Falls, N. Y., has just announced the completion of two new warehouse and office buildings in California, and has reorganized sales, engineering and other services in the West into what is now designated the Pacific District, which includes the area west of the Rockies. Mr. John G. Fritzinger, formerly a sales executive in Niagara Falls, New York, has been named Manager of the District.

The Pacific District organization will bring together in a coordinated program the product sales and engineering services of all divisions of the Company.

The new warehouse and office buildings are located near Los Angeles and San Francisco. The Los Angeles structure, located at 2626 South Malt Avenue, provides 13,000 sq. ft. of floor space for warehouse functions and 2000 sq. ft. for office operations.

The other one-story building erected at the corner of Alviso Road and Evelyn Avenue, Mountain View, California (near San Francisco) provides 18,000 sq. ft. of floor space for warehouse use, 2000 sq. ft. for lathe room and service area, and 1600 sq. ft. for office functions. Both facilities are convenient to railroads and main highways and are equipped with car height loading docks and modern materials handling facilities.

Bodinson Promoted By Hammond Iron

Hammond Iron Works, New York, N. Y. has announced the appointment of Earl H. Bodinson as Eastern Division Sales Manager with headquarters at the New York City offices.

Bodinson is well known throughout eastern oil and chemical industries having spent 16 years in that area; the last 8 years with the Hammond Iron Works. Recently he has been district sales manager at Bristol, Pa. Bodinson was graduated from the University of Illinois with the degree of Bachelor of Science.

For Accurate Measurement of

RAW WATER, TRADE WASTES, SEWAGE

Specify SIMPLEX TYPE S PARABOLIC FLUME

Intelligent planning of industrial waste or sewage treatment facilities requires accurate flow data. Accurate control of processes and dosages are wholly dependent on accurate flow measurements.

Quite often, conventional types of primary devices can't answer this basic question because of adverse conditions such as: low flows under low head conditions; very wide flow ranges; heavy sediment or suspended solids; size, layout or grade of existing approach section; corrosive liquors in channels or pipes.

Simplex Type S Parabolic Flume was designed specifically to master *all* of these problems . . . accurately measures free-flowing wastes or sewage over a FULL 20 to 1 flow range!

Compact Type S Parabolic Flume is simple to install . . . requires a minimum of supporting structure, as shown in the above installation. Carefully machined levelling pins assure the correct grade for accuracy. No special approach section is needed.

Available in standard pipe sizes of 6" to 36", with bell, spigot or flanged inlet, Type S Parabolic Flume can be attached to even larger pipe sizes by means of eccentric reducers.

INTERESTING FREE BULLETIN

Why not get full details today. Write for Bulletin WS-2, Simplex Valve & Meter Company, 7 East Orange St., Lancaster, Pa.

IT'S SIMPLEX IT'S ACCURATE

SIMPLEX®

VALVE AND METER COMPANY

Reilly Tar Appoints Hinkle

Reilly Tar & Chemical Corporation, Indianapolis, Indiana, has announced the appointment of Robert S. Hinkle as a member of the company's Protective Coating Sales Group.

A recent graduate of the University of Illinois where he was a member of the Sigma Alpha Epsilon Fraternity, Mr. Hinkle served with the U. S. Army Air Force in the European Theatre of Operations during World War II.

Mr. Hinkle will have his headquarters in Granite City, Ill., where he will be associated with the Reilly group headed by E. E. Goodman, District Manager.

New Filter Research Center

The Eimco Corporation, Salt Lake City, Utah, has announced that their new Research and Development Center, located in Palatine, Illinois, is the first of its kind devoted exclusively to the service of the process industries in liquid-solids separation through filtration.

Every known type of filtration equipment will be at work in this laboratory and when research shows that something new can be built for the benefit of the trade, engineers will follow it through design and production.

Projects of interest to many industries are in research at the present time. All of these projects are concerned with more economical use of natural resources, more economical separation of materials now regarded as too complex and expensive for general use and the design of new equipment to make the theory a practical, proven fact.

The Research Center is equipped to test samples and present pilot plant determinations to industries with filtration problems.

Herig Appointed By Beaver Pipe Tools

Beaver Pipe Tools, Inc., Warren, Ohio, has announced that Mr. Russel Herig, formerly associated with the Nye Tool Co., Chicago, has been appointed Field Sales Manager.

Mr. Herig, prior to his association with the Nye Tool Co., was sales representative for the Long Island Hardware Co. and C. H. Tieboutt and Sons Co., of New York.

Rockwell Names District Managers

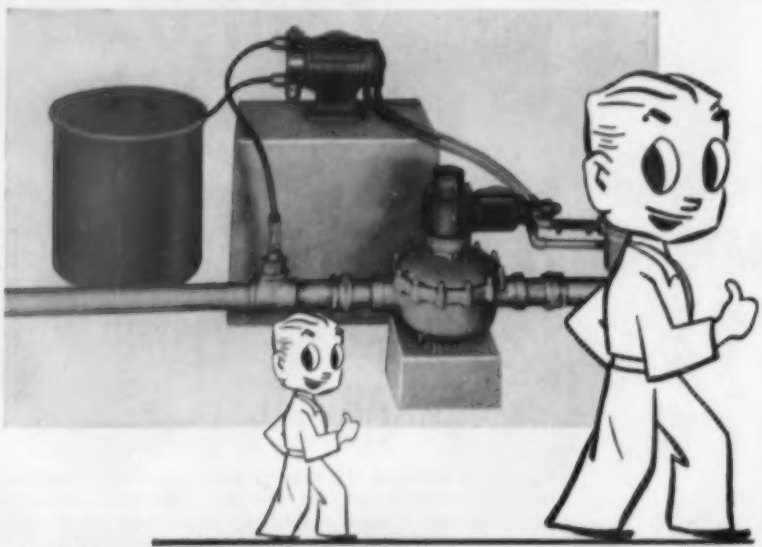
Rockwell Manufacturing Co., Meter and Valve Division, Pittsburgh, Pa., has announced the appointments of three new district managers in the south and midwest.

Mr. Dean Collins, has been named for the Shreveport, La., area; Mr. Edward D. Propps, Dallas, Texas; and Mr. Herbert M. Logan for the Tulsa, Oklahoma, area.

Halvorsen Joins Mills Plastic Pipe Div.

The Mills Plastic Pipe Division of Continental Can Company, New York, N. Y., has announced the appointment of John J. Halvorsen as director of technical services. Mr. Halvorsen will act as liaison between the sales, research and manufacturing sections of the Mills division at its plant in Chicago, and will serve under R. A. Vogt, division manager of research and engineering.

Mr. Halvorsen was formerly connected with the Crane Company of Chicago as Supervising Engineer for valves, fittings and flanges.



FEED RATE FOLLOWS FLOW RATE *Automatically*

For treating gravity fed water supplies, here's a natural. The only power required to drive Proportioneers Automatic and Proportional Chem-O-Feeder is the flow of water through the pipe line itself. The Chem-O-Feeder delivers water treating chemicals in strict proportion to the main flow: low flow . . . low feed — high flow . . . high feed.

Simple and dependable, the Chem-O-Feeder is paced by a standard main line, by-pass, or fire line meter — and is easily adapted to most any meter already in service. The meter does not drive the pump but serves simply as a control unit — thus the accuracy of the meter itself is in no way impaired. Bulletin SAN-6 gives complete details . . . send for your copy today. Proportioneers, Inc., 350 Harris Avenue, Providence 1, Rhode Island.

PROPORTIONEERS
DIVISION OF B-I-F INDUSTRIES, INC.
BUILDERS IRON FOUNDRY • OMEGA MACHINE CO. • BUILDERS-PROVIDENCE, INC.
BIF METERS FEEDERS CONTROLS

Piepenbrink Joins American Water Softener

American Water Softener Company, Philadelphia, Pa., has announced the appointment of Piepenbrink Engineering Co., 53 W. Jackson Blvd., Chicago 4, Illinois, as their midwestern representative covering Iowa, Wisconsin, Northern Illinois and Northern Indiana.

Mr. Piepenbrink, who is president of the new company has for the past 12 years been associated with the Cochrane Engineering Corp. of Chicago as Senior Sales Engineer. The new company will sell and service industrial and municipal water conditioning equipment as manufactured by American.

Appoints Wood Sales Manager

The Ric-Wil Company, Barberton, Ohio, has announced the appointment of Mr. William F. Wood as General Sales Manager. Mr. Wood was formerly District Manager in charge of the Washington, D. C., office and has been with Ric-Wil for the past 16 years. A graduate of the University of Omaha, he is a member of the American Society of Heating and Ventilating Engineers and the Armed Forces Chemical Association. He replaces Mr. C. W. Wheeler, who is retiring.

Howell Named Sales Manager For Sterling Electric

Sterling Electric Motors, Inc., Los Angeles, Calif., has announced that John R. Howell has been named Sales Manager and Director of the Company.

Mr. Howell has been associated with Sterling for over 25 years and has had experience in all phases of the sales and management field. He will direct 24 District Offices and over 400 Distributors and Service Representatives.

Summerville Appointed To Hall Laboratories Headquarters

Hall Laboratories, Pittsburgh, Pa., has announced that J. E. Summerville, formerly a field service engineer in its Birmingham, Alabama, district office, has been appointed a member of the headquarters staff located at Pittsburgh, Pa.

He has previously worked out of the St. Louis and Pittsburgh offices of Hall Laboratories, Inc.

A native of Rimersburg, Pa., Mr. Summerville is a graduate of the Carnegie Institute of Technology. He is a member of the American Insti-

(Continued on page 104A)

CEMENT GUN COMPANY RESTORES 15 MILLION GALLON RESERVOIR WITH "GUNITE"

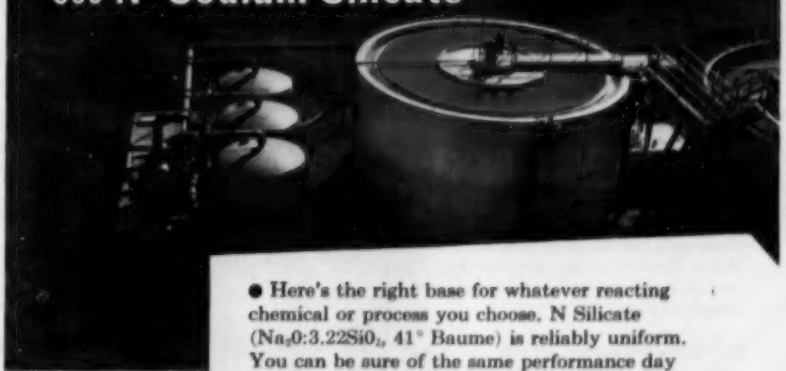
This 15 million gallon reservoir of a large Virginia municipality was made "better than new" with a 2" thick "Gunite" lining placed by a Cement Gun Company crew. The structure had been leaking badly through construction joints and required grouting behind the slopes in order to fill voids formed by the leakage. With reinforcing mesh in place, we applied "GUNITE" to the slopes and out 8 feet on bottom. Results were so pleasing to city officials that we were asked to repair an adjacent 5 million gallon reservoir.

Free Bulletin C3000 illustrates many examples of repair and new construction completed with "GUNITE" by the Cement Gun Company. A request on your letterhead will bring a copy by return mail.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES – ALLENTOWN, PA., U. S. A.

MANUFACTURERS OF THE "CEMENT GUN"

Coagulating with activated silica sol?
Use N Sodium Silicate



● Here's the right base for whatever reacting chemical or process you choose. N Silicate ($Na_2O:3.22SiO_2$, 41° Baume) is reliably uniform. You can be sure of the same performance day after day.

Convenient deliveries in tank cars or drums from nine plants: Anderson, Ind.; Baltimore, Md.; Buffalo, N. Y.; Chester, Pa.; Jeffersonville, Ind.; Kansas City, Kansas; Rahway, N. J.; St. Louis, Mo.; Utica, Ill. Distributors' stocks in over 65 cities.

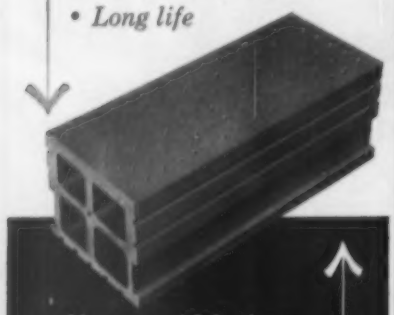
Ask for samples for jar tests, also for information on any of our N-Sol Processes* for preparing activated silica sols as coagulant aids.

N-Sol® Processes
PQ® SOLUBLE SILICATES

*N-Sol patented processes are licensed without royalty.

PHILADELPHIA QUARTZ CO.
1166 Public Ledger Bldg.
Philadelphia 6, Pa.

- *Permanence*
- *No tuberculation*
- *Equal distribution*
- *Uniform filtration*
- *Low loss of head*
- *Acid, alkali-resistant*
- *Long life*



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LEOPOLD

Glazed Fire Clay

TILE FILTER BOTTOMS

Today, in more than 250 plants with a daily capacity of over 1¼ billion gallons, Leopold Duplex Filter Bottoms are providing dependable, economical service with minimum maintenance.

Made of highest quality de-aired fire clay—vitrified and salt glazed, the Leopold Filter Bottom requires only a shallow depth of small sized, inexpensive filter gravel to support the filtering medium. Further, the laterals and distributing blocks are all combined in one strong permanent unit that will last indefinitely.

Adaptable to any rectangular filter unit, the Leopold Glazed Tile Filter Bottom is designed to successfully meet all underdrain requirements.

Each Leopold filter block is about 2 sq. ft. in area—weighs approximately 100 pounds.

Complete Water Purification and Sewage Plant Equipment . . .

- **DRY CHEMICAL FEEDERS**
- **FILTER OPERATING TABLES**
- **MIXING EQUIPMENT**

Want more details? Write us today.

F. B. Leopold Co., Inc.
2413 W. Carson Street
Pittsburgh 4, Pa.

(Continued from page 103A)

tute of Chemical Engineers and of Phi Kappa Phi Fraternity. During World War II, he was a B-29 flight engineer.

Ray New Sales Manager For Weinman Pump

The Weinman Pump Mfg. Co., Columbus, Ohio, has announced the appointment of Harvey R. Ray as Sales Manager. Mr. Ray was named to replace E. D. Bader, the company's former sales manager who died last summer.

In his new position, Mr. Ray will be in charge of all sales and product promotion activities including direction of the national and export sales organization. He will also supervise the development of new markets for the Weinman line of industrial and commercial centrifugal pumps.

A graduate in mechanical engineering from Michigan State College, Mr. Ray has a broad background in all phases of pump design, manufacture and sales, and will use his technical experience in the engineering application of pumping equipment.

Yardley Opens Atlanta Warehouse

Yardley Plastics Co., Columbus, Ohio, has announced a new warehousing service at 565 Western Ave. N.W., Atlanta, Ga.

"This new facility will enable us to give overnight and pickup service to our dealers and distributors in the Southern States," said Robert W. Rosel, Sales Manager.

Thompson Joins Rhodia, Inc.

Rhodia, Inc., New York, N. Y., has announced that Warren B. Thompson, formerly with E. I. du Pont de Nemours & Co., has been appointed as sales representative in the Middle Atlantic states, with headquarters in Philadelphia.

In his new position, Mr. Thompson will be responsible for sales of aromatic chemicals and the products of the Alamask Industrial Reodorants Division.

Mr. Thompson was born and educated in Philadelphia and has spent the last ten years in that territory as du Pont sales representative for aromatic chemicals and industrial reodorants.

there should be EDDY HYDRANTS in your future installation plans because:

- They are mechanically *right* and simple in design—built to highest standards of craftsmanship—for decades of dependable operation with minimum maintenance.
- Easily serviced by one man, without special tools or heavy rigs.
- Large waterways—open smoothly *with* the pressure and close without water hammer.
- Drip action positively drains standpipe, safeguarding against freeze-ups.
- Available with all types of connections.
- 106 years' successful operation assures availability of repair parts.
- Meet all A.W.W.A. specifications.

Send today for full information on the complete line of Eddy Valves and Hydrants. No obligation.

EDDY VALVE COMPANY
A Subsidiary of James B. Clow & Sons
WATERFORD, NEW YORK

W&SW

New Literature

BalanCel Pneumatic Transmitter

222

Builders-Providence, Inc., Division of B-I-F Industries, Inc., has announced the publication of a technical bulletin describing its newly-developed **BalanCel Pneumatic Transmitter.** A low cost, simple, sensitive device, this unit is designed especially for measuring flow, level, and differential pressures in water filtration and sewage plants, and for low pressure industrial service. The bulletin contains photographs, installation diagrams, and dimension drawings illustrating the advantages, uses, and operation of this compact transmitter, which operates on the force-balance principle.

Swimming Pool Filtration Systems

223

R. P. Adams Company, Inc., Buffalo, N. Y., has just released a new 24-page bulletin on **Filtration for Modern Swimming Pools** of 50,000 gallon capacity and over.

This publication has sections on design features of purification and filtering systems, the operation phases of the filtration cycle, choosing the right filter for your swimming pool, installation drawings, dimension charts and a table on filter sizes for given pool sizes at various flow rates.

Comminutor Engineering Manual

224

Worthington Corporation, Harrison, New Jersey, has just published a **Comminutor Engineering Manual.**

This well illustrated, 28-page, 2-color manual discusses the following: General Description; Principal Advantages; Sectional Elevations; Construction and Maintenance; How the Comminutor Functions; Selection and Application; Comminutor Hydraulic Performance graphs; Dimensions; and Typical Channel Designs, for Comminutors.

The hydraulic curve section covers: Downstream submergence graph at channel end; Head and capacity for Parshall flumes; Velocity and discharge in rectangular channels; and Solution of Manning's formula.

Also included are descriptions and photographs of Worthington's testing facilities, typical installation photos, a data sheet for Comminutor installations and a typical specification form.

Standby Electric Plants

225

United States Motors Corporation, Oshkosh, Wis., has available 2 bulletins on **Gas-Gasoline** and **Diesel Electric Plants.**

These bulletins show photographs of some models along with a short description of the features and standard equipment. Complete

(Continued on page 106A)

tomorrow is too late!

Call in National today!

Dirty, clogged water mains are a serious—dangerous threat to any fire fighting organization. Low water pressure caused by incrusted pipes often makes the difference between minor damage and major conflagration. Yes, dirt can mean disaster. Your community deserves the extra-protection of clean water mains.

And, National with almost a half-century of cleaning experience can guarantee restoration of any water main to at least 95% of its original rated capacity!

Call National today—tomorrow could be too late!

Call in National today!

NATIONAL WATER MAIN CLEANING COMPANY

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ATLANTA, GA; 333 Candler Building • BERKELEY, CALIF; 905 Grayson Street • DECATUR, GA; P. O. Box 385 • BOSTON, MASS; 115 Peterboro Street • CHICAGO; 122 So. Michigan Avenue ERIE, PA; 439 E. 6th Street • FLANDREAU, S.D.; 315 N. Crescent Street • KANSAS CITY, MO; 406 Merchandise Mart and 2201 Grand Avenue • LITTLE FALLS, N.J.; BOX 91 • LOS ANGELES; 5075 Santa Fe Avenue • MINNEAPOLIS, MINN; 200 Lumber Exchange Building • RICHMOND, VA; 210 E. Franklin Street • SALT LAKE CITY; 149-151 W. Second South Street • SIGNAL MOUNTAIN, TENNESSEE; 204 Slayton Street • MONTREAL, CANADA; 2032 Union Avenue • WINNIPEG, CANADA; 576 Wall Street • HAVANA, CUBA; Lawrence H. Daniels, P.O. Box 531 • SAN JUAN, PUERTO RICO; Luis F. Carotini, Apartado 2184.

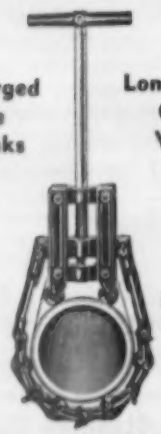
Surer Gland Lubrication for Centrifugal Pumps

THE Z-F GREASE SEAL

Eliminates that trouble spot where shaft enters casing. Applies constant positive lubrication to packing and shaft—automatically. Excessive heat, rapid wear, leakage and scoring will disappear as the Grease Seal applies a constant flow of lubrication when pump starts until it stops—automatically. Many other advantages, too. Write for complete description and price.

ZIMMER and FRANCESCON
MOLINE, ILLINOIS

HEAVY-DUTY
ELLIS PIPE CUTTER
FOR CUTTING LARGE SIZE PIPE



Drop-Forged Frame and Links

Long-Lasting Cutter Wheels

Makes a Hit With Water Works Men

Cuts Pipe in or Out of Ditch

TWO SIZES
No. 01 for 4" to 8" Pipe
No. 1 for 4" to 12" Pipe

Write for Circular and Price List No. 35WS

ELLIS & FORD MFG. CO.
FERNDALE 20, MICH.

(Continued from page 105A)

tables are given showing the KVA, KW, Model, Starting type, Volts, Cycle, Phase and Wire for each model made by the company. General specifications and types of controls are also given.

Recommended Painting Practices for Water Plants

226

Tropical Paint Co., Cleveland, Ohio, has just released a 15 page report on **Recommended Maintenance Painting Systems for Water Treatment Plants.**

The report presents 13 approved systems of maintenance painting. Each system applies to a certain field of surfaces or equipment found in water treatment plants, with recommendations for maximum surface protection where fumes, high humidity and water can cause paint failures.

Also included in the report is a table of 109 different types of equipment and surfaces found in water works, with qualifying data as to type of surface, exposure and whether it is submerged. Each listing is keyed to one of the approved painting systems. This provides a simple cross-reference which suggests the best paint system to use for each equipment surface.

Laying Concrete Pressure Pipe

227

Price Brothers Company, Dayton, Ohio, has available a booklet entitled **"Concrete Pressure Pipe, Laying Instructions".**

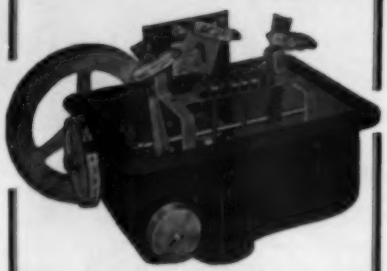
The booklet, using everyday workman's language, explains each step with short, to-the-point, paragraphs and illustrates each step with actual on the job photographs and line drawings. A check list of miscellaneous equipment and supplies needed and their uses is also given.

Rubber-Seat Butterfly Valves

228

Builders-Providence, Inc., Division of B-I-F Industries, Inc., Providence, R. I., has issued a color bulletin on its newly expanded line of **Butterfly Valves.** This bulletin contains information on Butterfly Valve advantages, sizes, pressures, velocities, operators, and positioners; shows general arrangement dimension prints of various size valves with manual, electric, hydraulic, and pneumatic operators. In addition, it contains photographs and detailed descriptions of each Butterfly Valve component.

ROTO-TROL



RF-2

WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles. The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

Write for full data

WATER LEVEL CONTROLS DIVISION
HEALY-RUFF COMPANY
783 HAMPDEN AVE., ST. PAUL 4, MINN.

BALDWIN ALUMINA SET

For quickly determining the residual alum in filtered water. The complete apparatus includes reagents, color standards and portable hardwood carrying case. The case protects the apparatus from possible contamination with alum dust. Complete with directions for use.

82-760 ..... Each $65.00

Write

Phipps & Bird, Inc.
6th & Byrd St., Richmond, Virginia
(2305 Rhode Island Ave., N.E. Washington, D. C.)

Since 1885

GRUENDLER

The Choice of Municipal Plants

25 Sewage Shredder Installations **in 1954**

Coney Island, N.Y., Sewage Works
Kimball, Nebraska
Bedford, Virginia
Cleveland, Ohio, Hopkins Airport
Brooklyn, New York
White Bear Lake, Minnesota
St. Petersburg, Florida Airport
Houston, Texas
Albuquerque, New Mexico
Villa Park, Ill., Drainage Basin
Clear Lake, Iowa
Wichita, Kansas, T.W.A.
Lexington, Virginia
Provo, Utah
Montgomery, Alabama
Camden, New Jersey
U.S. Army, Ft. Bliss, Texas
Monkato, Minnesota
Charlestown, Mass., Pumping Sta.
New Bedford, Massachusetts
Waco, Texas
Henderson, Kentucky

Two Gruendler Sewage Shredder Installations, Port Huron, Michigan

GRUENDLER SEWAGE GARBAGE SHREDDERS

Disintegrates waste, including rag stock for continuous uninterrupted flow.

BULLETIN S.G. 10, mailed on request

GRUENDLER

Crusher & Pulverizer Co.

2915 North Market St. Louis 6
DEPT. WSW2 MISSOURI

Selective Telemetering Applications

229

Motorola Communications & Electronics, Inc., Chicago, Illinois, has available a 12 page bulletin on **Selective Telemetering Applications.**

The bulletin states that information about power flow, water flow, level, etc., and many other values is required for effective remote operation of pumping stations, tank levels and other installations. Yet, the bulletin points out, most central control stations provide the operator with much less data than he would have if he were manning the remote station, for it is seldom economically feasible to continuously telemeter all such information.

A method that provides a satisfactory answer to this cost problem is described in the bulletin. It tells how a compromise can often be made to provide some information continuously while other data can be "selected" when needed by the operator. The shared use of telemeter communication channels with supervisory control systems that permit actual remote control of valves, motors, etc., not only reduces the original cost of transmitting equipment, but also cuts space requirements and permits the shared use of telemetering instrumentation and sensing devices.

Gate Valve Operation

230

Payne Dean & Company, Clinton, Connecticut, has available a bulletin on **Gate Valve Operation, The Payne Dean Way.**

The bulletin lists six reasons why power operation of valves and gates should be used, then gives a complete description of the various types of power equipment that can be used. Photographs show installation of the units in various sizes and types of trucks and car bodies along with portable power units, and electrically operated units.

The bulletin is amply illustrated and includes a list of references.

Submersible Sewage Ejector

231

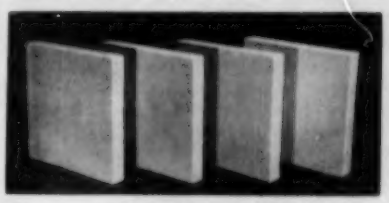
The Weil Pump Company, Chicago, Illinois, has just published a bulletin on **Weil Submersible Sewage Ejectors.**

Amply illustrated with photographs, cut-away drawings, dimension and installation drawings, the bulletin discusses: the sub-

(Continued on page 108A)

FILTROS

brings Substantial SAVINGS and Increased EFFICIENCY to Water Filtration



Modern porous plate underdrain systems of FILTROS silica offer new efficiency in water filtration — PLUS installation and maintenance savings. Consider these advantages:

1. No graded gravel needed.
2. Complete back washing.
3. Prevents formation of mud balls.
4. Porous plates resist corrosion.
5. Round grain construction gives better filtration rate.
6. No metal parts to corrode.
7. Built for maximum efficiency and economy.
8. Maintenance easy; required less frequently.
9. Last indefinitely.

We will gladly show you how FILTROS can modernize and simplify your filtration system at moderate cost. Write today for complete information.

FILTROS Porous Plates and Tubes for Air Diffusion in Sewage Treatment Plants also have outstanding advantages. Ask for information.

FILTROS INC.

602 W. Commercial St., East Rochester, New York
Pioneer Manufacturers of Porous Ceramics Since 1913

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

GATE OPERATORS — PORTABLE — FOR STANDS & UNDERGROUND GATES—MOTOR TRUCK MOUNTED
PAYNE DEAN & CO.
CLINTON, CONN.

FOR MAKING SERVICE CONNECTIONS QUICKLY, EASILY!

SKINNER-SEAL SERVICE SADDLE

For steel, cast iron and Transite pipe. Single massive bolt. Sizes 1" to 12" inclusive. Write for catalog.

M. B. SKINNER COMPANY
SOUTH BEND 21, INDIANA

MUNICIPAL SUPPLIES
W. S. DARLEY & CO.
Write Today for 100 Page Catalog
W. S. DARLEY & CO., Chicago 12

Switch to ANTHRAFILT
Trade Mark Reg. U.S. Pat. Off.
the modern, all-purpose filtering medium
BEST for every type of filter
Address all inquiries to:
PALMER FILTER EQUIPMENT CO.
822 E. 8th St. Erie, Pa.
Representing ANTHRACITE EQUIPMENT CORP. Wilkes-Barre, Pa.

HYDRO-TITE
DEPENDABLE JOINTING COMPOUND
Seals Bell and Spigot Water Mains
Economical—Effective
Over 35 Years Of Dependable Performance

HYDRAULIC DEVELOPMENT CORP.
MAIN SALES OFFICE 50 CHURCH ST., N. Y. C.
General offices and works W. Medford Sta., Boston, Mass.

(Continued from page 107A)

mersible sewage ejector; typical installations; non-clog bladeless impeller; deep sumps and wide pits; lift stations; dimensions and sump covers; control equipment; construction details; performance and selection tables; and general engineering data.

Economical Restoration Of Worn Cylinder Liners

232

Van Der Horst Corporation, Olean, N. Y., has available a 12-page booklet on **Porus-Krome**, the economical cylinder reliner.

Treated in a question and answer manner, the booklet describes Porus-Krome as a pure, hard chromium that is applied to cylinder bores and other bearing surfaces by the Van der Horst process which produces pores to hold lubricating oil. It reduces wear, corrosion and risk of piston seizure. According to the booklet it multiplies cylinder life 3 to 10 times and ring life 2 to 5 times.

Each question and answer is illustrated with a photograph or drawing, and several case histories are given.

Dur-Ace Plastic Pipe

233

American Hard Rubber Company, New York, N. Y., has just released a bulletin on **Dur-Ace Plastic Pipe, Fittings and Valves.**

General properties of the multipolymer rigid plastic pipe, together with chemical resistance tables, standard sizes, pressures, and prices of pipe, fittings, and diaphragm valves are included, together with installation and fabrication data.

Double Disc, Parallel Seat Gate Valves

234

The Ludlow Valve Manufacturing Co. Inc., Troy, N. Y., has just published a new thirty-six page bulletin, describing **Double Disc Parallel Seat Gate Valves.**

The new bulletin contains complete information, covering the construction and operation of waterworks valves. In addition to innumerable photographs, cutaway views, schematics and tables, covering valves in detail, the bulletin includes helpful information pertaining to rollers, tracks and scrapers, gearing, hydraulic actuating cylinders, motor operators, floor stands and accessories used in valve operation.

Sanitary Screening Equipment

235

Link-Belt Company, Colmar, Pa., has published a booklet on **Screening Equipment for Water, Sewage and Industrial Waste.**

It gives complete dimension and specification data for four types of coarse screens for removing large solids, and three types of fine screens (with screen cloth) for removal of small solids. Tables to determine the proper size unit for handling various capacities are given.

The booklet explains that coarse screens are for installation at plants where the water contains heavy solids that might damage or clog subsequent equipment. They normally consist of a series of parallel bars in the flow channel, and the accumulated debris is removed by powered toothed rakes.

Discussed in detail are three types of coarse screens especially designed for sewage and industrial solids removal (a) Thru-Clean, (b) Straightline and (c) Tritor screens. Each as ¾ to 3-in. bar openings, depending principally on the character and volume of debris. Trash screens, designed for power plant and water plant intakes, are also covered.

Fine screens are also described as being designed to remove smaller solids, and can be applied to prevent pollution of streams, recover valuable products or serve as water intake screens. Instead of bars, these devices use a relatively fine mesh screen cloth to collect the solids.

Three types of fine screens are described in the booklet. They are (a) the revolving drum type, which rotates on a horizontal axis with the flow entering the inside of the drum and passing through the screen cloth which covers the drum; (b) disc screen type, which is a wire cloth covered wheel rotating on a horizontal axis with the water flowing through the cloth parallel to the axis; and, (c) liquid vibrating screens with very fine mesh for use when a relatively dry product is required.

The booklet contains over 30 photographs of screening installations and information about the application of this equipment to get efficient, low cost screening.

Anti-Rust Paints

236

The Chem Industrial Co., Cleveland, Ohio, has just released a 4-page information bulletin describing the

(Continued on page 110A)

How to
CUT COSTS
and get better
SEWAGE EJECTION
told in BULLETIN S-50
by BLACKBURN-SMITH

Eliminate complex piping . . . do without screens, impellers, and shredders that need constant, costly cleaning . . . get dependable, automatic operation . . .

. . . in short, get better sewage ejection for less money. You'll find out how in Blackburn-Smith Bulletin S-50 which the coupon will bring you. These time-tested pneumatic sewage ejectors have float and electrode controls, and a snap-action valve that's both float and pneumatically controlled.

For details about the BEST in modern sewage ejection, mail the coupon today.

BLACKBURN-SMITH MFG. CO.
55 GARDEN ST., HOBOKEN, N. J.
HO 3-4425 N.Y. Tel., BA 7-0600

Blackburn-Smith Mfg. Co.
55 Garden Street, Hoboken, N. J.
I want to know how I can get better sewage ejection at lower cost.
Name.....
Company.....
Address.....
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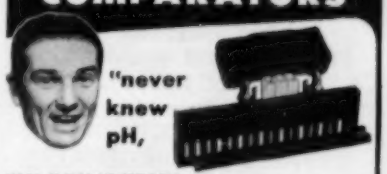
TAYLOR COMPARATORS



"never knew pH, CHLORINE TESTS could be so easy!"

You can make pH, chlorine or bromine determinations in a matter of seconds by only three simple steps with Taylor Comparators. Complete water analysis, including fluorides, is only a little more detailed when you use a Taylor Water Analyzer. Taylor sets are lightweight, durable, portable. Many different tests can be made on a single base. Best of all . . .

COLOR STANDARDS ARE GUARANTEED

Taylor liquid color standards carry an unlimited guarantee against fading, thus there's no danger of mechanical inaccuracy. A complete set of standards for each determination is housed in a single slide. No single standards to handle.

SEE YOUR DEALER for Taylor sets or write direct for **FREE HANDBOOK**, "Modern pH and Chlorine Control". Gives theory and application of pH and chlorine control. Illustrates and describes full Taylor line.

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354 B.C.
"Hippocrates' sleeve" (a cloth straining bag) was a popular water treatment method in the 4th Century B.C.

For excellence in MODERN water treatment equipment —gravity and pressure filters— recirculation apparatus . . .

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

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607 COLUMBIA AVE., DARBY, PA.

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Overlooking beautiful Lincoln Park. 10 minutes to Chicago Loop. Public transportation few steps from door. Home of The Chat Room, unique dining and cocktail lounge. Coffee Shop serving excellent meals. Complete hotel service.

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ASSISTANT PLANT SUPERINTENDENT
Position open for assistant to the Superintendent of the Sewer Department. Send complete resume to Superintendent Sewer Department, Sewage Treatment Plant, Riverside, R. I.

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(Continued from page 109A)

company's complete line of **Overust Anti-Rust Paints.**

Chemical properties, application methods and coverage figures are listed for Overust black, red, gray, green, aluminum and clear. The bulletin also emphasizes that the paints will stand up under rust conditions which would quickly destroy ordinary paints.

Pump Controller Bulletins

237

T. F. Pike & Associates, St. Paul, Minn., has just released the first three of a new series of bulletins on the company's new line of **Watchman Tank and Pump Controllers.**

Bulletin W. T. 1 shows the front and back view of the controller chassis and lists the voltage, pressure ratings, external wiring, dimensions, etc.

Bulletin W. T. 2, on one side, explains how only one Watchman Controller model meets all the operating requirements of any elevated tank water system. The other side explains what the various components are used for.

Bulletin G. 1 gives a complete explanation of the guarantee offered by the company and lists a series of steps to take in the event of trouble with any of the units.

Crown Couplings

238

The De Laval Steam Turbine Co., Trenton, N. J., has just issued a new bulletin describing their line of **Crown Couplings.**

Included is an illustration showing an exploded view of the coupling and a table containing data necessary to select the correct coupling for a given application. Prices are also specified.

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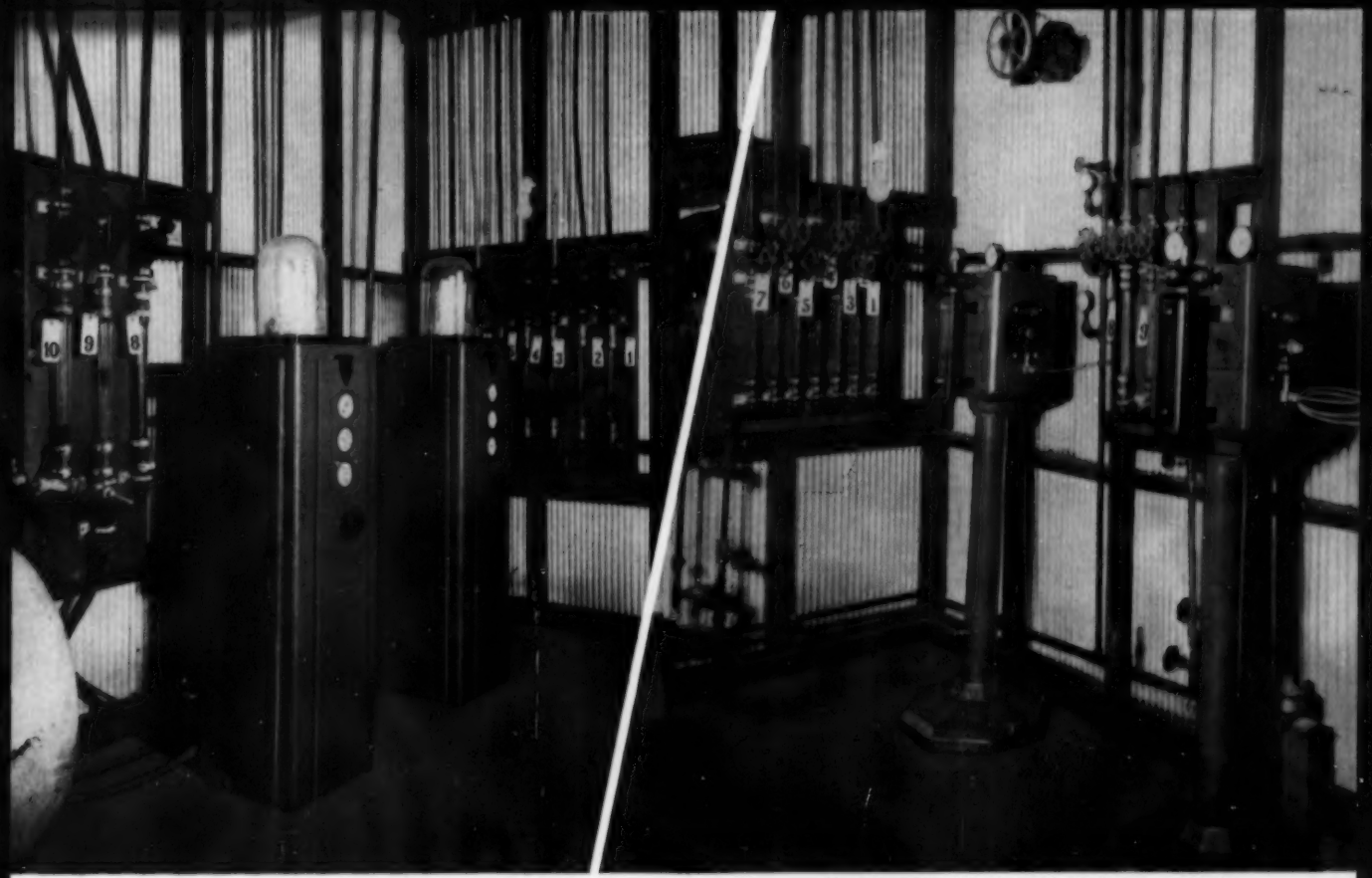

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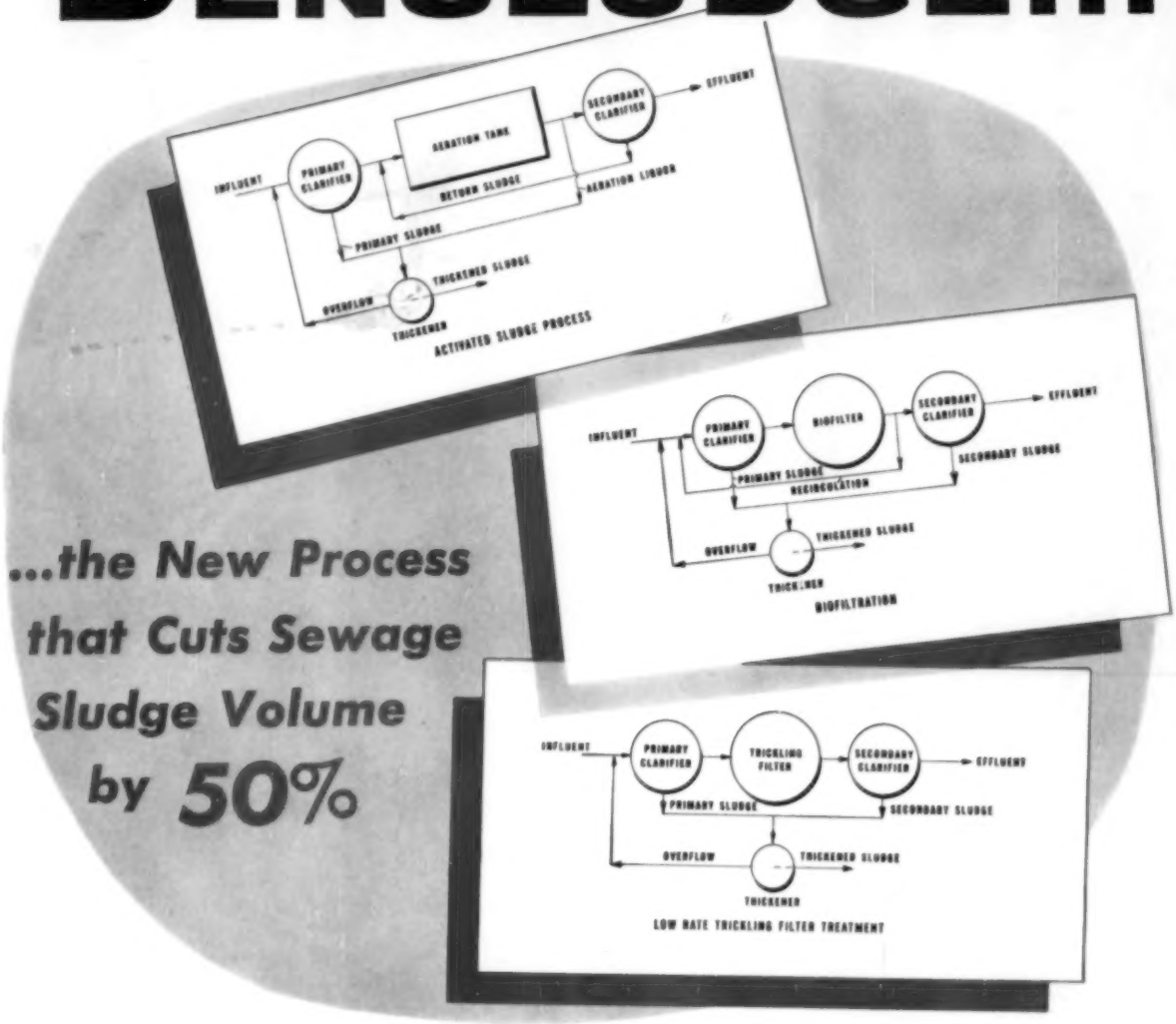

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